

**NORTH CAROLINA  
PUBLIC STAFF  
UTILITIES COMMISSION**

January 30, 2019

Ms. M. Lynn Jarvis, Chief Clerk  
North Carolina Utilities Commission  
4326 Mail Service Center  
Raleigh, North Carolina 27699-4300

Re: Docket No. E-2, Sub 1185 - Duke Energy Progress, LLC - Application  
for a CPCN to Construct a Microgrid Solar and Battery Storage  
Facility in Madison County, North Carolina

Dear Ms. Jarvis:

In connection with the above-captioned docket, I transmit herewith for filing  
on behalf of the Public Staff the public and confidential versions of the Testimony  
of Jeff Thomas, Utilities Engineer, Electric Division.

By copy of this letter, we are providing a confidential version to parties that  
have signed a confidentiality agreement, and copies of the public version to all  
other parties of record.

Sincerely,

/s/ Dianna W. Downey  
Staff Attorney  
[dianna.downey@psncuc.nc.gov](mailto:dianna.downey@psncuc.nc.gov)

Executive Director  
(919) 733-2435

Communications  
(919) 733-2810

Economic Research  
(919) 733-2902

Legal  
(919) 733-6110

Transportation  
(919) 733-7766

Accounting  
(919) 733-4279

Consumer Services  
(919) 733-9277

Electric  
(919) 733-2267

Natural Gas  
(919) 733-4326

Water  
(919) 733-5610

FBEFORE THE NORTH CAROLINA UTILITIES COMMISSION

DOCKET NO. E-2, SUB 1185

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

TESTIMONY OF  
JEFF THOMAS  
PUBLIC STAFF – NORTH  
CAROLINA UTILITIES  
COMMISSION

**BEFORE THE NORTH CAROLINA UTILITIES COMMISSION  
DOCKET NO. E-2, SUB 1185**

**Testimony of Jeff Thomas  
On Behalf of the Public Staff  
North Carolina Utilities Commission**

**January 30, 2019**

1 **Q. PLEASE STATE YOUR NAME, BUSINESS ADDRESS, AND**  
2 **PRESENT POSITION.**

3 A. My name is Jeff Thomas. My business address is 430 North  
4 Salisbury Street, Dobbs Building, Raleigh, North Carolina. I am an  
5 engineer with the Electric Division of the Public Staff – North Carolina  
6 Utilities Commission.

7 **Q. BRIEFLY STATE YOUR QUALIFICATIONS AND DUTIES.**

8 A. My qualifications and duties are included in Appendix A.

9 **Q. WHAT IS THE PURPOSE OF YOUR TESTIMONY?**

10 A. The purpose of my testimony is to present to the North Carolina  
11 Utilities Commission (NCUC or Commission) the Public Staff's  
12 analysis and recommendations on Duke Energy Progress, LLC's  
13 (DEP) application for a Certificate of Public Convenience and  
14 Necessity (CPCN) for the Hot Springs Microgrid project (Microgrid).  
15 The Microgrid consists of a 2-MW<sub>AC</sub> solar photovoltaic (PV) electric

1 generating facility coupled with a 4.4 MW lithium-based battery  
2 storage system and associated control devices.

3 **Q. PLEASE DESCRIBE THE MICROGRID APPLICATION.**

4 A. DEP submitted its application and exhibits (Application) in this docket  
5 on October 8, 2018, pursuant to N.C. Gen. Stat. § 62-110.1 and  
6 Commission Rule R8-61, requesting NCUC authorization to  
7 construct the solar PV portion of the Microgrid. DEP also states that  
8 it “request[s] appropriate approval from the Commission for its  
9 decision to construct and own the battery storage components of the  
10 Microgrid...” (Application, page 1). The Application is supported by  
11 the testimony and exhibits of DEP witness Jonathan Landy. On  
12 October 31, 2018, the NCUC issued an *Order Finding Application*  
13 *Incomplete*, which identified several deficiencies in DEP’s  
14 application. DEP filed the supplemental testimony of witness Landy  
15 on November 13, 2018 to correct the deficiencies.

16 **Q. HAS THE PUBLIC STAFF CONDUCTED DISCOVERY IN THIS**  
17 **MICROGRID PROCEEDING?**

18 A. Yes. The Public Staff has submitted, and received responses to, four  
19 data requests, with subparts, and also participated in conference  
20 calls with DEP and French Broad Electric Membership Corporation  
21 (FBEMC) personnel. These data requests and conference calls  
22 were focused on obtaining additional details of the project,

1 understanding the issues that led to the Microgrid proposal, and  
2 investigating project costs, benefits, and alternatives considered.

3 **Q. WHAT IS THE NEED FOR THE MICROGRID IDENTIFIED BY**  
4 **DEP?**

5 A. DEP states in the Application that the need for the Microgrid is based  
6 on improving the reliability of service to customers in the Hot Springs  
7 area. DEP intends for the Microgrid to support the goals and  
8 objectives of DEP's Western Carolinas Modernization Project  
9 (WCMP). Though DEP is not planning to apply for approval of the  
10 Microgrid as a New Renewable Energy Facility under N.C. Gen.  
11 Stat. § 62-133.8 in order to use the renewable energy certificates  
12 produced by the facility for purposes of complying with the  
13 Renewable Energy and Energy Efficiency Portfolio Standard, DEP  
14 believes that the Microgrid is consistent with and designed to  
15 promote the public policies of the State, specifically those  
16 enumerated in Senate Bill 3 (S.L. 2007-397). Additionally, DEP  
17 states the Microgrid is consistent with DEP's 2018 IRP, which calls  
18 for 80 MW of energy storage and approximately 1,000 MW of  
19 incremental solar installations over the next five years. Finally, DEP  
20 believes that to expand the use of energy storage resources on the  
21 broader DEP system at a significant scale, it is important for the  
22 Company first to gain experience operating and maintaining battery  
23 storage on small-scale projects such as the Microgrid.

1 Q. PLEASE DESCRIBE THE WESTERN CAROLINAS  
2 MODERNIZATION PROJECT.

3 A. Session Law 2015-110, commonly known as the Mountain Energy  
4 Act, required the Commission to provide an expedited review of an  
5 application filed by DEP for the construction of a natural gas-fired  
6 generating facility at the site of the existing Asheville coal-fired  
7 generating facility. Conditions in the law required DEP to cease  
8 operation of the coal-fired facility and limit capacity of the natural gas-  
9 fired facility to no more than twice that of the coal-fired facility.

10 On January 15, 2016, in response to the passage of the Mountain  
11 Energy Act, DEP filed a CPCN application in Docket No. E-2,  
12 Sub 1089, to construct and operate its WCMP. The proposed  
13 WCMP was comprised of two new 280-MW combined cycle (CC)  
14 units and one 186-MW simple cycle combustion turbine (CT) unit (to  
15 be built later).<sup>1</sup>

16 In its WCMP proposal, DEP also committed to seek a CPCN in the  
17 future to invest in a minimum of 15 MW of new solar generation in  
18 DEP's Western Region, with a portion being sited at the Asheville  
19 plant after the coal-fired units were demolished. In addition, DEP

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<sup>1</sup> DEP stated in its WCMP plan that construction of the CT was to be contingent on whether or not the implementation of other programs and technologies would be able to offset forecasted peak demand requirements in the region.

1 committed to invest in a pilot project with a minimum of 5 MW of  
2 utility-scale storage in DEP's Western Region.

3 On February 29, 2016, the Commission issued its *Notice of Decision*  
4 approving the construction and operation of the two combined cycle  
5 units. In part, the *Notice of Decision* also required DEP to retire the  
6 coal-fired units at the Asheville plant and file annual progress reports  
7 on: (1) construction of the combined cycle units, (2) DEP's efforts to  
8 work with its customers in DEP's Western Region to reduce peak  
9 load through demand-side management, energy efficiency or other  
10 measures, and (3) DEP's efforts to site solar and storage capacity in  
11 DEP's Western Region.

12 On March 28, 2016, the Commission issued its *Order Granting*  
13 *Application in Part, with Conditions, and Denying Application in Part*  
14 for the WCMP (WCMP Order). In summary, the Commission  
15 affirmed its *Notice of Decision* and denied without prejudice the  
16 CPCN for the CT. The Commission's order did not specifically  
17 approve the solar or storage proposed by DEP, but stated that it  
18 expected DEP to file as soon as practicable the CPCN to construct  
19 at least 15 MW of solar at the Asheville plant or in the Asheville  
20 region. The Commission further urged DEP to move forward in a  
21 timely manner with the 5 MW storage project in the Asheville region.  
22 Finally, the Commission required DEP to include information in its

1 annual progress reports on its efforts to site solar and storage  
2 capacity in DEP's Western Region.

3 On March 28, 2017, DEP filed its first annual progress report on the  
4 WCMP. In it, DEP noted the creation of the Energy Innovation Task  
5 Force (EITF), which is working with DEP and Asheville area  
6 residents to investigate cost-effective methods of complying with the  
7 WCMP Order, including energy storage technologies. DEP  
8 proposed to deploy up to 10 batteries (total capacity is over 5 MW  
9 but final amount to be determined), with each installation sited and  
10 configured to serve multiple functions (e.g., frequency regulation and  
11 back-up power). DEP also discussed its proposed Mt. Sterling  
12 Microgrid Project,<sup>2</sup> a 10-kW solar PV facility coupled with 95 kWh of  
13 battery storage.

14 On March 28, 2018, DEP filed its second WCMP annual progress  
15 report. The WCMP Battery Storage Deployment Plan was updated,  
16 with the total energy storage capacity target increased to 50 MW. In  
17 it, DEP stated that:

18 Through a cost-effective and prudent battery storage  
19 deployment plan, the Company will evaluate the  
20 impacts of deploying batteries of a significant scale on  
21 the electric system, explore the nature of new offerings  
22 desired by customers, and fill knowledge gaps. Utility-  
23 owned and operated batteries will enable the Company  
24 to leverage bulk purchases of equipment and material,

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<sup>2</sup> DEP obtained a CPCN for this project in Docket No. E-2, Sub 1127.



1 build relationships with battery developers,  
2 manufacturers, and installers, and develop capabilities  
3 as an owner and operator of a battery fleet.<sup>3</sup>

4 DEP also updated the NCUC on the Mt. Sterling Microgrid, stating  
5 that it is operating as intended with only a few minor issues related  
6 to control and monitoring equipment and software.

7 **Q. IS THE MICROGRID CONSISTENT WITH DEP’S COMMITMENT**  
8 **AND THE COMMISSION’S EXPECTATION FOR DEP TO SITE**  
9 **SOLAR AND BATTERY STORAGE IN DEP’S WESTERN**  
10 **REGION?**

11 A. Yes. Construction of the Microgrid would be consistent with the  
12 Commission’s expectation, set out in the WCMP Order, that DEP  
13 would site solar and battery storage in the Asheville region.  
14 However, the Commission did not require the siting of solar and  
15 battery storage without regard to the need or cost-effectiveness of  
16 individual projects. Thus, the Public Staff engaged in discovery to  
17 determine whether the Microgrid cost-effectively meets the need for  
18 the project that were identified by DEP.

19 **Q. PLEASE DESCRIBE THE HOT SPRINGS AREA.**

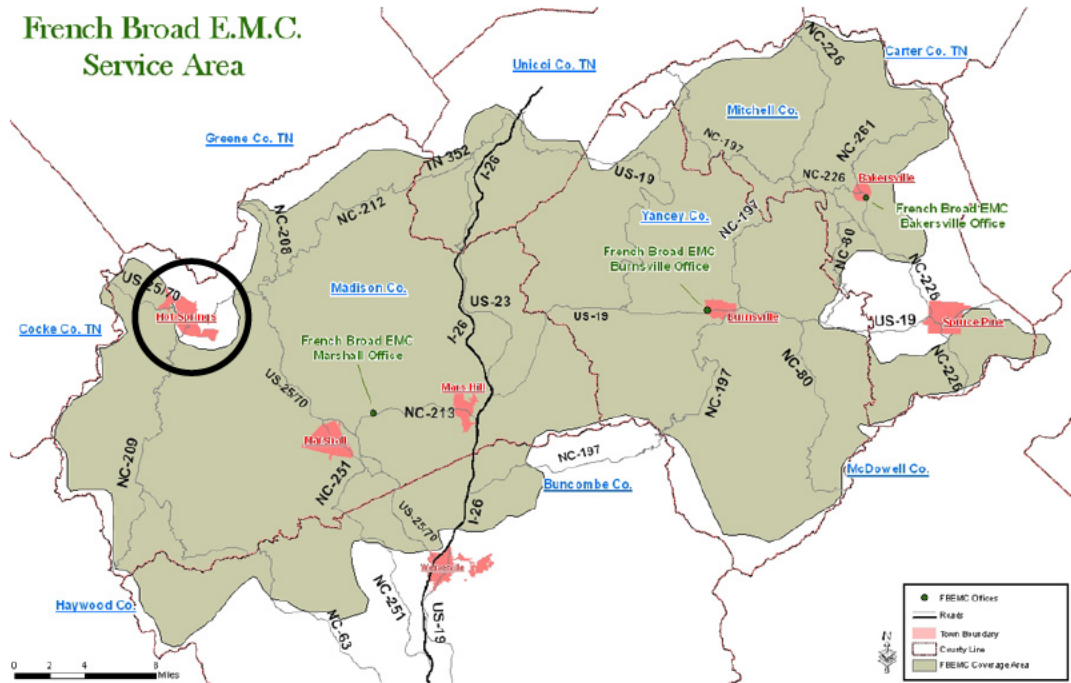
20 A. Hot Springs is a small town in Madison County, North Carolina, with  
21 approximately 600 DEP retail electric service customers in DEP’s

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<sup>3</sup> DEP WCMP Second Annual Progress Report at p. 7, filed on March 28, 2018, in Docket No. E-2, Sub 1089.

1 Western Region. Electric service in Hot Springs is supplied via a  
 2 single radial 23-kV distribution line of approximately 10.5 miles that  
 3 runs from DEP's Marshall Substation to the southeast through  
 4 rugged, mountainous terrain. DEP's Western Region has  
 5 approximately 160,000 customers and covers all or parts of several  
 6 counties in the general Asheville area. DEP's Western Region is  
 7 geographically separate from DEP's Eastern Region and is  
 8 somewhat isolated from other nearby electric utilities due to limited  
 9 transmission interties in the area. The Hot Springs area that is  
 10 served at retail by DEP is surrounded to the west, south, and east by  
 11 FBEMC, as shown in Figure 1.

12 *Figure 1: French Broad EMC Service Area (Hot Springs circled)*



13

1 Q. IS THE PUBLIC STAFF AWARE OF ANY RECENT ISSUES  
2 REGARDING ELECTRIC SERVICE IN THE HOT SPRINGS  
3 AREA?

4 A. Yes. During the summer of 2016, the Public Staff began receiving  
5 complaints from DEP retail customers in the Hot Springs area  
6 regarding power outages. In August 2016, a member of the Public  
7 Staff attended a meeting in Hot Springs with the Mayor of Hot  
8 Springs, commercial customers in the area, and representatives of  
9 DEP. The commercial customers expressed their concern about  
10 outages that were lasting for an hour or more and occurring during  
11 weekends when local businesses such as restaurants had many  
12 customers to serve. The representatives of DEP explained the  
13 difficulties in serving Hot Springs that I described earlier in my  
14 testimony (e.g., a single long distance, radial distribution line over  
15 rugged mountain terrain). DEP pledged to improve service reliability  
16 by conducting a thorough visual survey of the distribution line and  
17 performing more aggressive vegetation management. The Public  
18 Staff contacted some of the commercial customers who attended the  
19 August, 2016 meeting in early 2017, and they indicated that reliability  
20 had improved.

1 Q. HAS DEP QUANTIFIED THE SERVICE ISSUES IN THE HOT  
2 SPRINGS AREA AS PART OF THIS PROCEEDING?

3 A. Yes. In response to discovery, DEP provided a 15-year history of the  
4 System Average Interruption Duration Index (SAIDI) and System  
5 Average Interruption Frequency Index (SAIFI), two commonly used  
6 reliability metrics, for both Hot Springs and DEP's Western Region.  
7 These statistics are summarized in Figure 2 below.

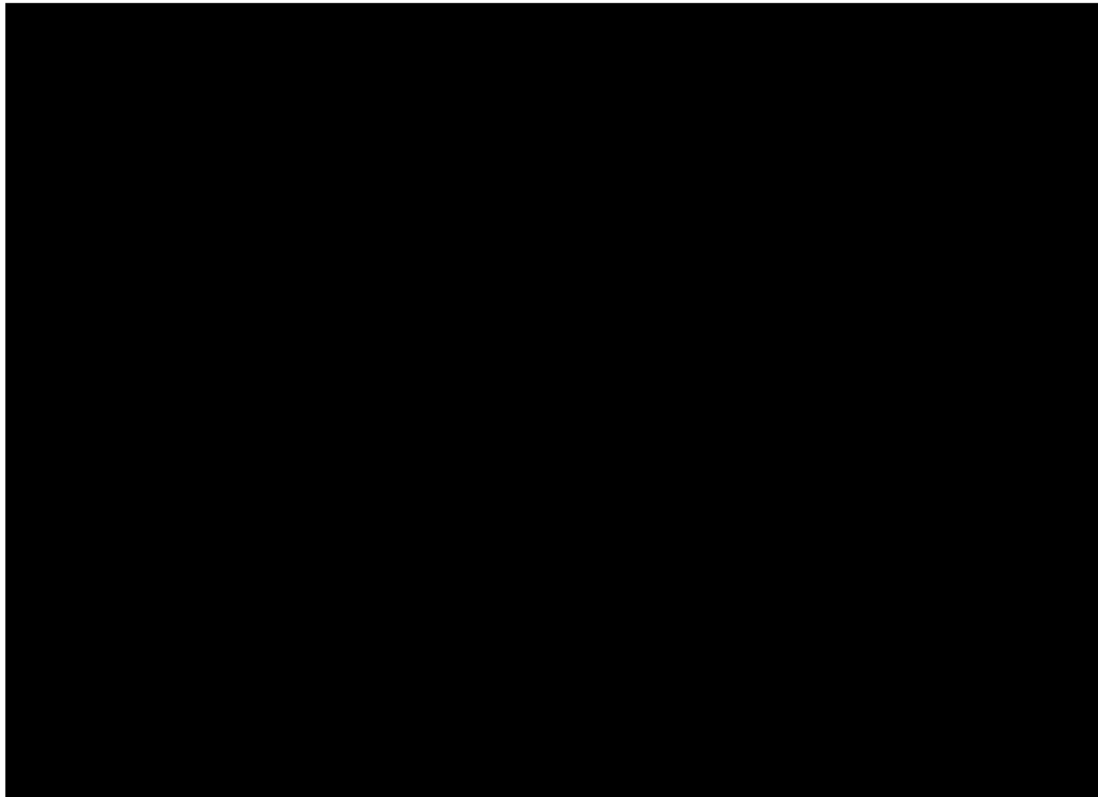
8 [BEGIN CONFIDENTIAL]

9

[REDACTED]

[REDACTED]

10



1

2 **[END CONFIDENTIAL]**

3 **Q. COULD THE MICROGRID IMPROVE RELIABILITY IN THE HOT**  
4 **SPRINGS AREA?**

5 A. Yes. During normal operation, the Microgrid will be connected in  
6 parallel with and export energy to the DEP grid. During an outage  
7 event, i.e., a fault on the Hot Springs distribution line, the Microgrid  
8 would then be able to supply power to Hot Springs in island mode.  
9 Hot Springs customers would notice a momentary power outage as  
10 the Microgrid disconnects from DEP's grid and begins supplying  
11 power to the town; essentially, Hot Springs customers would not be  
12 immediately impacted by the distribution line fault. This power would  
13 come from the solar PV array based on its expected generation

1 during daylight hours and from the battery system in hours when the  
2 PV array is not generating or capable of supplying the power needs  
3 of the area. According to a presentation provided to the Public Staff  
4 in September of 2018, DEP indicates that the battery is sized to meet  
5 100% of Hot Springs' peak load and is capable of providing for the  
6 90<sup>th</sup> percentile load for approximately four hours without any  
7 contribution from the solar PV generation.

8 **Q. IS THE MICROGRID INCLUDED IN THE COMPANY'S 2018**  
9 **INTEGRATED RESOURCE PLAN (IRP)?**

10 A. Yes. While I would note that the Commission has not yet approved  
11 DEP's 2018 IRP for planning purposes, I do agree that DEP's 2018  
12 IRP includes 140 MW of 4-hour lithium ion batteries in the base case  
13 as "placeholders for future assets to provide operational experience  
14 on the DEP system."<sup>4</sup> The battery resources were not economically  
15 selected, however, by the IRP's System Optimizer model. I will also  
16 note that the short term plan in DEP's 2017 IRP Update called for  
17 investment in a limited number of battery storage projects to gain  
18 additional operation and technical experience with evolving utility-  
19 scale storage technologies.<sup>5</sup>

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<sup>4</sup> DEP 2018 North Carolina Integrated Resource Plan at p. 94, filed on September 1, 2018, in Docket No. E-100, Sub 157.

<sup>5</sup> DEP's 2017 IRP Update Report at p. 68, filed on September 1, 2017, in Docket No. E-100, Sub 147.

1 Q. WHAT ARE THE COSTS AND RATE IMPACT OF THE  
2 MICROGRID?

3 A. The capital costs of the Microgrid are presented in Table 1 below.  
4 DEP projects that the facility will have annual operating costs of  
5 [BEGIN CONFIDENTIAL] [REDACTED] [END  
6 CONFIDENTIAL] and will increase NC retail customer rates by  
7 [BEGIN CONFIDENTIAL] [REDACTED]  
8 [REDACTED] [END  
9 CONFIDENTIAL] in the first year. In addition, DEP expects that the  
10 battery system will require augmentation in year ten at a cost of  
11 [BEGIN CONFIDENTIAL] [REDACTED]. [END  
12 CONFIDENTIAL]

13 [BEGIN CONFIDENTIAL]

14 [REDACTED]

[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]

15 [END CONFIDENTIAL]

16 Q. WHAT ALTERNATIVES TO THE MICROGRID DID DEP  
17 CONSIDER?

18 A. In its initial testimony and exhibits, DEP states that it did not consider  
19 wholesale market purchases to be a viable alternative due to the

1 unique circumstances of the Microgrid and the Commission's WCMP  
2 Order requirements.<sup>6</sup>

3 Witness Landy in his supplemental testimony identified two  
4 alternatives to the Microgrid evaluated by DEP. The first was to  
5 construct a second distribution feeder into Hot Springs by connecting  
6 to FBEMC. According to witness Landy, a detailed cost estimate of  
7 this alternative was not developed because the option presented  
8 several challenges that made it infeasible: obtaining right of way in  
9 this region would be challenging, and the tie into DEP's and  
10 FBEMC's system would result in significant infrastructure  
11 investments. In discovery, DEP additionally asserted that this  
12 alternative is infeasible because a backup power arrangement with  
13 FBEMC might violate certain regulatory conditions.

14 The second option identified by witness Landy was to reconnector  
15 and rebuild the existing feeder to modern storm/mountain hardening  
16 standards. According to witness Landy, this alternative would  
17 involve replacing the existing poles and structures with higher class  
18 poles for greater strength, adding guying to each pole, and replacing  
19 the existing conductor. However, this alternative would still leave Hot  
20 Springs with a single feed that would still be susceptible to outages.

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<sup>6</sup> See Direct Testimony of Jonathan A. Landy, page 11.



1 DEP notes that while these alternatives would provide improved  
2 reliability to Hot Springs customers, neither would provide the  
3 additional bulk system benefits provided by the Microgrid.

4 **Q. DID DEP PROVIDE ANY COST ESTIMATES FOR THESE**  
5 **ALTERNATIVES?**

6 A. Witness Landy did not present the cost estimate for the FBEMC  
7 alternative in his supplemental testimony. Upon the Public Staff's  
8 request, DEP produced a preliminary cost estimate of running a  
9 second feed from FBEMC into Hot Springs, totaling **[BEGIN**  
10 **CONFIDENTIAL]** [REDACTED]  
11 [REDACTED]  
12 [REDACTED]  
13 [REDACTED]. **[END CONFIDENTIAL]**.

14 With respect to storm/mountain hardening of the existing distribution  
15 feeder, DEP estimated this option would cost **[BEGIN**  
16 **CONFIDENTIAL]** [REDACTED] **[END**  
17 **CONFIDENTIAL]**.

18 Obviously, both of the identified alternatives, on their face, cost less  
19 than constructing the Microgrid. However, in its cost benefit analysis,  
20 DEP included certain bulk system benefits of the Microgrid.

1 Q. WHAT SYSTEM BENEFITS DOES DEP BELIEVE THE  
2 MICROGRID WILL PROVIDE?

3 A. DEP has identified four main categories of bulk system benefits that  
4 it used in its cost benefit analysis: (1) excess solar energy delivered  
5 to the grid, (2) ancillary services such as frequency regulation and  
6 ramping support, (3) conveyance of microgrid and battery storage  
7 operational knowledge to DEP personnel, and (4) the value of RECs  
8 generated by the solar PV system.

9 Q. DO YOU BELIEVE THAT THE ESTIMATED BENEFITS OF THE  
10 MICROGRID, INCLUDING THE BULK SYSTEM BENEFITS, AS  
11 CALCULATED BY DEP, ARE CERTAIN ENOUGH TO BE RELIED  
12 ON IN THIS PROCEEDING?

13 A. No. Based upon our investigation, we were unable to confirm the  
14 benefits of deferring storm hardening, to verify the magnitude of the  
15 estimated bulk system benefits that would be actually realized, or to  
16 ensure that the benefits realized from the Microgrid will be passed  
17 on to DEP ratepayers.

18 For example, on a net present value (NPV) basis, the deferral of the  
19 storm/mountain hardening alternative comprised a majority of the  
20 benefits DEP claimed. However, on a January 8, 2019 conference  
21 call, DEP's Western Region personnel indicated that due to recent  
22 service quality improvements, absent a future unfavorable trend in

1 reliability metrics, DEP did not plan to make the storm/mountain  
2 hardening investments on the Hot Springs feeder and would instead  
3 continue with standard vegetation management on the feeder,  
4 including the Hazard Tree Assessment Program<sup>7</sup>, regardless of  
5 whether the Microgrid project were to go forward.

6 The next largest category of claimed benefits is frequency regulation,  
7 in which the Microgrid would provide constant up and down  
8 regulation reserves when not operating in island mode. To estimate  
9 these benefits, DEP took a multi-year average of historic market  
10 clearing prices related to the Midcontinent Independent System  
11 Operator's (MISO) entire Regulation Reserves market. The  
12 Microgrid project will be outfitted with a battery inverter system  
13 technically capable of providing these benefits, and as the Microgrid  
14 provides this service, less fuel will be consumed at the thermal plants  
15 that traditionally provide regulation reserves. However, the Public  
16 Staff believes that the Regulating Reserves market clearing prices in  
17 MISO do not necessarily reflect equivalent fuel savings in DEP's  
18 system, as DEP does not participate in a regional market.

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<sup>7</sup> For DEP's distribution system, a typical right-of-way is 30' (15' on center). The Hazard Tree Assessment program allows access to an additional 30' on both sides of the right-of-way to address trees that are deemed hazardous to the distribution system. These trees are typically rotten, soon to be dead, or otherwise clearly failing in health.

1 **Q. WHAT IS YOUR POSITION ON THE ESTIMATED SYSTEM**  
2 **BENEFITS?**

3 A. While I do believe that the Microgrid will provide benefits to DEP  
4 ratepayers, I do not believe that DEP has enough information  
5 currently to make an accurate estimate of those benefits. In  
6 particular, the ancillary service benefits associated with the battery  
7 storage system – frequency, voltage, and ramping support – cannot  
8 be accurately quantified without actual operational data gained from  
9 experience and meticulous data collection and analysis. However, I  
10 recognize the value that Microgrid operational knowledge can  
11 provide to DEP, particularly as nascent energy storage technologies  
12 become more widely deployed.

13 **Q. DOES THE PUBLIC STAFF BELIEVE THAT OVERALL, THE**  
14 **PROJECT IS THE MOST COST EFFECTIVE SOLUTION TO**  
15 **SERVICE QUALITY ISSUES IN THE HOT SPRINGS AREA?**

16 A. No. Although the Microgrid would improve reliability and service  
17 quality in the Hot Springs area, because the Public Staff was unable  
18 to verify or quantify the benefits of the project, the Microgrid does not  
19 appear to be the most cost effective method of doing so.

1 Q. GIVEN THAT THE PUBLIC STAFF DOES NOT BELIEVE THAT  
2 THE MICROGRID IS THE MOST COST EFFECTIVE SOLUTION  
3 TO SERVICE QUALITY ISSUES IN THE HOT SPRINGS AREA,  
4 WHAT DOES THE PUBLIC STAFF RECOMMEND REGARDING  
5 THIS APPLICATION?

6 A. While I do not believe that the Microgrid is the most cost effective  
7 way to address reliability and service quality issues at Hot Springs, I  
8 do believe the overall public convenience and necessity would be  
9 served by granting the CPCN for the solar facility and approving the  
10 Microgrid as a pilot project. In my opinion, the system benefits from  
11 the Microgrid are material, even if they are difficult to estimate  
12 accurately without real world experience in DEP's service territory.  
13 In addition, while this project is not currently a cost effective way to  
14 address reliability, it appears to be consistent with the WCMP Order  
15 and the Commission's expectation that DEP pursue a battery  
16 storage project in the Asheville region.<sup>8</sup> As such, after reviewing the  
17 application, including the costs and unique benefits, the Public Staff  
18 recommends that this Microgrid be treated as a pilot project and the  
19 CPCN for the solar facility be approved, subject to certain reporting  
20 requirements, a study of frequency regulation, the imposition of a cap

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<sup>8</sup> This is not to say that every solar or battery storage project proposed by DEP for the Asheville area should be approved by the Commission simply because it is consistent with the WCMP Order. Each project should be assessed independently pursuant to applicable statutes to ensure that the public interest will be served and investment in the project is reasonable and prudent.

1 on the above-the-line capital costs of the project, and other  
2 conditions, as discussed below.

3 The reporting requirements are designed to ensure that the system  
4 benefits generated by the Microgrid can be accurately quantified in  
5 order to assist the NCUC and the Public Staff in future cost benefit  
6 analyses of projects with energy storage. In addition, this information  
7 could be used to develop programs and tariffs, and that information  
8 could be provided under an appropriate pricing arrangement to other  
9 interested parties. Upon information and belief, much of the data I  
10 am recommending be collected and reported will either already be  
11 tracked or could be tracked by DEP.

12 In my opinion, the public will ultimately benefit from this project if the  
13 right data is collected and if DEP is transparent with its learning goals  
14 and lessons learned. In addition, as energy storage prices decline,  
15 storage applications and services<sup>9</sup> are better identified, and  
16 deployment rises, the public will benefit from an electric utility with  
17 real-world operational experience with such systems.

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<sup>9</sup> A more detailed discussion of the various storage applications and services can be found in *Energy Storage Options for North Carolina*, p. 10, published December 5, 2018, and accessible at:

<https://energy.ncsu.edu/storage/wp-content/uploads/sites/2/2018/12/NC-Storage-Study-FINAL.pdf>

1 **Q. WHAT REPORTING REQUIREMENTS DO YOU RECOMMEND?**

2 A. In an effort to better quantify the actual bulk system benefits that  
3 battery storage could provide to DEP, if the Commission approves  
4 this application, I recommend DEP be required to do the following:

5 1. Within six months of NCUC approval of this Application,  
6 formalize and provide its operational and learning goals in a  
7 transparent and comprehensive plan, showing how it will  
8 achieve such goals and what operational data from the  
9 Microgrid will be measured and recorded.

10 2. File with the Commission a status report on the progress of  
11 construction and actual project costs in the same format as for  
12 initial costs of construction six months after the date of the  
13 CPCN and at the completion of construction.

14 3. Annually report, update, and file with the Commission and  
15 provide to the Public Staff, confidentially, the results of its  
16 operational knowledge and learning goals to demonstrate the  
17 operational benefits of the Microgrid. At a minimum, this  
18 report should include:

19 a. A detailed event summary of all instances in which the  
20 Microgrid operated in island mode, whether in  
21 response to an outage on the Hot Springs distribution  
22 line or otherwise. This summary should include a

- 1 discussion of how outage duration and frequency were  
2 affected by the Microgrid, and document any instances  
3 in which an outage was not able to be entirely mitigated  
4 due to the limited capacity of the energy storage  
5 system.
- 6 b. An annual summary of Microgrid operations, including  
7 hourly data, with enough specificity to determine:
- 8 i. Where solar PV energy was directed (to grid or  
9 to battery), including the percentage of energy  
10 sent to each source;
- 11 ii. How the battery was charged (from the solar PV  
12 system or the grid), including the percentage of  
13 total energy from each source;
- 14 iii. How the battery was discharged, and for what  
15 purpose (islanding, ancillary services, etc.),  
16 including the total number of charge/discharge  
17 cycles, typical depth of discharge, hourly state  
18 of charge, and any other recorded  
19 characteristics.
- 20 c. A discussion of how, if at all, the actual Microgrid  
21 operations deviated from projections made in this  
22 docket.



- 1 d. A quantification of the total ancillary services provided  
2 to the grid by the Microgrid project (in both capacity and  
3 energy), including what types of services were  
4 provided (spinning reserve, regulation up or down, etc.)  
5 and whether these services displaced ancillary  
6 services traditionally provided by thermal plants.
- 7 e. To the extent possible, an estimate of any savings  
8 realized from the energy storage system's ancillary  
9 services.
- 10 f. A summary of how the Microgrid enhanced economic  
11 operations and how it was beneficial to DEP's  
12 operational knowledge (i.e., lessons from design  
13 engineers regarding programming the device or  
14 maintenance personnel regarding operations and  
15 management costs; Microgrid behavior in light of bulk  
16 system dynamics, etc.).
- 17 g. A description of how the battery system has degraded  
18 over time to include loss of: (1) storage capacity, (2)  
19 output capacity, and (3) ability to provide ancillary  
20 services.
- 21 h. Costs of installed capital upgrades and retirements, in  
22 the same format as for initial costs of construction.

- 1 i. Operations and maintenance costs, by FERC account  
2 and with descriptive footnotes explaining purpose  
3 (ongoing maintenance, specific repairs, etc.).

4 **Q. PLEASE EXPLAIN THE STUDY YOU ARE RECOMMENDING.**

5 A. I recommend that the Commission require a study, performed either  
6 by a third party or by DEP as part of their integrated systems and  
7 optimization planning initiative, to estimate the ancillary service  
8 benefits battery storage can provide DEP's system, using sub-hourly  
9 modeling techniques similar to the Astrapé Solar Integration Cost  
10 Study in Docket No. E-100, Sub 158, and use the results to help  
11 quantify the success of the Microgrid. In addition, the results could  
12 be used in future battery storage proposals, providing more  
13 confidence that estimated benefits used to justify battery storage  
14 projects would actually be realized by DEP ratepayers. This study  
15 should aim to separately quantify and value the various ancillary  
16 services batteries can provide, such as spinning and frequency  
17 reserves. If possible, this study should analyze different energy  
18 storage technologies of varying durations to determine the most cost  
19 effective energy storage technology and duration for each type of  
20 ancillary service provided. The Commission should require this  
21 study to be completed by 15 months after commercial operation of  
22 the Microgrid commences.



1 diligence consistent with prudent industry practice, and (3) outside of  
2 the reasonable control of DEP (“Force Majeure Events”). For  
3 purposes of this recommendation, “Force Majeure Events” shall  
4 include (1) extreme weather events (including named storms,  
5 tornadoes, earthquakes, floods, and forest fires), war, acts of  
6 terrorism, epidemics, natural disasters, and other Acts of God, (2)  
7 discovery of latent and unknown site conditions, and (3) changes in  
8 State or federal law through judicial, legislative, or  
9 executive/administrative action or interpretation implemented,  
10 enacted, adopted or otherwise ordered after the date the CPCN is  
11 approved.<sup>10</sup>

12 **Q. DO YOU HAVE ANY OTHER RECOMMENDATIONS?**

13 A. Yes. I further recommend that the Commission condition the CPCN  
14 on the following:

15 1. That DEP construct and operate the Microgrid in strict  
16 accordance with all applicable laws and regulations, including the  
17 provisions of all permits issued by the North Carolina Department of  
18 Environmental Quality;

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<sup>10</sup> Duke Energy Indiana (DEI) agreed to certain reporting requirements and a cost cap in a settlement reached with the Office of Utility Consumer Counselor (OUCC) staff related to DEI’s application to recover the costs of certain battery storage projects. See *Order of the Commission* dated May 30, 2018 in Indiana Cause No. 45002.

1           2.     That issuance of the CPCN does not constitute  
2           approval of the final costs associated with the construction of the  
3           Microgrid for ratemaking purposes and the order is without prejudice  
4           to the right of any party to take issue with the ratemaking treatment  
5           of the final costs in a future proceeding; and,

6           3.     That DEP maintain, including vegetation management,  
7           the existing radial distribution feed into Hot Springs in a manner that  
8           under normal circumstances should produce SAIDI and SAIFI  
9           indices that are at least comparable to those of the overall DEP  
10          Western Region.

11   **Q.     DOES THIS CONCLUDE YOUR TESTIMONY?**

12   **A.     Yes, it does.**

Jeffrey T. Thomas

I graduated from the University of Illinois Champaign-Urbana in 2009, earning a Bachelor of Science Degree in General Engineering. Afterwards, I worked in the manufacturing sector in various operations management roles for electronic manufacturing companies such as General Electric and United Technologies Corporation. I left manufacturing in 2015 and attended North Carolina State University (NCSU), earning a Master of Science degree in Environmental Engineering. My educational experience includes cost benefit research on smart grid components at the Future Renewable Energy Electricity Delivery and Management (FREEDM) Systems Engineering Research Center and power system modeling. My master's thesis focused on electric power system modeling, capacity expansion planning, and the effect of various state and nation-wide energy policies in North Carolina. After completing my graduate degree, I joined the Public Staff in November 2017. In my current role, I have worked on the implementation of HB 589 programs, utility cost recovery, renewable energy program management, customer complaints, and other aspects of utility regulation.