
PUBLIC SERVICE COMMISSION OF SOUTH CAROLINA

In the Matter of Annual Review of Base Rates for Fuel Costs for Duke Energy Progress, LLC }
} }
} Docket No. 2016-3-E
} }
}

**Surrebuttal Testimony of
Thomas Vitolo, PhD**

**On Behalf of
South Carolina Coastal Conservation League and Southern Alliance for
Clean Energy**

**On the Topic of
NEM Methodology 2016 Application
Annual Review of Base Rates for Fuel Costs for Duke Energy Carolinas,
LLC**

September 1, 2016

Table of Contents

1.	INTRODUCTION.....	1
2.	OVERARCHING NEM PRINCIPLES	2
3.	NEM CATEGORIES	4
	Avoided Criteria Pollutant Costs.....	4
	Avoided Transmission and Distribution Capacity Costs	5
	Avoided Environmental Costs	7
	Avoided Line Losses	10
4.	CONCLUSION	13

1 **1. INTRODUCTION**

2

3 **Q. Please state your name and business address for the record.**

4 A. My name is Tommy Vitolo, and I am a Senior Associate with Synapse Energy
5 Economics (Synapse) at 485 Massachusetts Avenue, Suite 2, Cambridge,
6 Massachusetts 02139.

7

8 **Q. Have you previously submitted direct testimony in this proceeding?**

9 A. I have.

10

11 **Q. What is the purpose of your surrebuttal testimony?**

12 A. The purpose of my surrebuttal testimony is to respond to the rebuttal testimony of
13 Duke Energy Carolinas, LLC (DEC or the Company) Witness Glen Snider.

14

15 **Q. Are you sponsoring any exhibits?**

16 A. Yes. I am sponsoring the following exhibit:

- 17 • TV-1 (Summary of Avoided Transmission and Distribution Capacity
18 Cost Studies).

1 **2. OVERARCHING NEM PRINCIPLES**

2

3 **Q. Do you find DEC’s guiding principles for providing direction to the overall**
4 **DEC valuation methodology sufficient?**

5 A. I do not. Company witness Snider states on page 5, lines 6 and 7 of his rebuttal
6 testimony that “three guiding principles are employed to provide direction to the
7 overall process.” The three principles he listed are “but for,” “utility known &
8 measurable,” and “once & only once” (Witness Snider Rebuttal, page 5, line 8;
9 page 5, line 15; page 5, line 21).

10 He does not include the principle of completion. That is, Witness Snider does not
11 include a principle of the Company ensuring that it has diligently pursued
12 calculation and inclusion of all costs and avoided costs in the distributed energy
13 resource (DER) valuation process. Completing the valuation is critical to ensure
14 compliance and fairness. As such, I believe it should be one of DEC’s guiding
15 principles.

16

17 **Q. You’ve argued that DEC should include an additional guiding principle, but**
18 **do you find that all three of DEC’s guiding principles are appropriate?**

19 A. I do not.

20

21 **Q. Do you find that DEC’s “but for” principle is appropriate?**

22 A. The “but for” framing is appropriate, but care must be taken to differentiate this
23 process from PURPA. The standards for which costs and benefits can be included
24 in a PURPA avoided cost calculation are more stringent than those for which
25 costs and benefits can be included in the DER valuation. Much like an integrated
26 resource plan (IRP), the DER valuation allows for reasonably expected avoided
27 costs even if they haven’t yet been precisely measured.

1 **Q. Do you find that DEC’s “utility known & measurable” principle is**
2 **appropriate for this proceeding?**

3 A. I do not. “Known & measurable” is useful in a variety of utility ratemaking tasks,
4 but DER valuation is not limited to this particular standard. The appropriate
5 standard for DER valuation in South Carolina is “quantifiable.” This can be found
6 in the Settlement Agreement approved in Docket No. 2014-246-E: whereas Duke
7 preferred the use of “known and measurable”,¹ the term “quantifiable” is the
8 Settlement Agreement terminology approved to describe the threshold by which
9 an avoided cost should be included.² The difference may be subtle, but it is
10 important. A “quantifiable” avoided cost can be estimated based on studies of
11 other utility systems, the testimony of experts, or even Commission
12 approximations. “Quantifiable” allows for the inclusion of a broader set of costs
13 and avoided cost calculation methodologies than a “known & measurable”
14 standard.

15
16 **Q. Do you find that DEC’s “once & only once” principle is appropriate?**

17 A. I do. I would add that while including each cost or avoided cost once and only
18 once is appropriate, each cost and avoided cost should be assigned to the category
19 that best represents that cost or avoided cost. Each cost and avoided cost should
20 appear once and only once, and each cost and avoided cost should be included in
21 its appropriate category.

¹ *Settlement Agreement*, Docket No. 2014-246-E at II.5.

² *Ibid.* at III.8.

1 **3. NEM CATEGORIES**

2

3 *Avoided Criteria Pollutant Costs*

4 **Q. Did DEC included a non-zero value for avoided criteria pollutant costs in its**
5 **proposed DER valuation?**

6 A. No. DEC listed the value as \$0.00000 and included a footnote that the avoided
7 criteria pollutant costs are included in the avoided energy costs.

8

9 **Q. Did Witness Snider agree that DEC can readily isolate the avoided criteria**
10 **pollutant component of the total energy value?**

11 A. Yes. On page 8, lines 1 and 2 of his rebuttal testimony, Witness Snider states that
12 DEC “can isolate the avoided criteria pollutant component of the total avoided
13 energy value.”

14

15 **Q. What do you recommend the Commission require with respect to avoided**
16 **criteria pollutant costs?**

17 A. I recommend that the Commission require DEC to list the avoided criteria
18 pollutant costs in the avoided criteria pollutant category. I recommend this for the
19 following reasons:

- 20 1. Doing so would adhere to the principle of completeness.
- 21 2. Doing so would provide transparency—while it is true that DEC has provided
22 these values in discovery, ratepayers as well as intervenors are entitled to a
23 clear accounting of the costs and avoided costs provided by distributed energy
24 resources.
- 25 3. Doing so is not a significant burden for DEC; the mechanics necessary to
26 include the cost in both on-peak and off-peak values already exists. Those
27 mechanics are used for other portions of the DER valuation.

1 *Avoided Transmission and Distribution Capacity Costs*

2 **Q. Is there agreement between you and the Company that there are non-zero**
3 **avoided costs or benefits associated with avoided transmission and**
4 **distribution capacity?**

5 A. Yes. Indeed, Company witness Snider states on page 9, line 7 and 8 of his rebuttal
6 testimony that he “would generally agree that there likely is a transmission and
7 distribution impact associated with placing intermittent resources on the grid.”

8

9 **Q. Did DEC comment on its ability to quantify avoided transmission and**
10 **distribution capacity costs?**

11 A. Yes. Witness Snider states on page 11, line 16 of his rebuttal testimony that the
12 Company does not “have sufficient capability and information to quantify both
13 the costs and the benefits related to the T&D impacts of DER adoption at this
14 time.”

15

16 **Q. Does this mean that the Company should use a value of \$0.00000?**

17 A. No. Company witness Snider states that the avoided costs or benefits of avoided
18 T&D capacity is not “known and measurable enough at this point for inclusion as
19 a positive or negative value of DER adoption.” (Witness Snider Rebuttal, page 9,
20 line 10-12). I believe his conclusion is flawed for two reasons. First, “known and
21 measurable” is not the appropriate standard. As discussed earlier, the appropriate
22 standard is “quantifiable.” Second, DEC’s inability to quantify the value in-house
23 does not mean that the value is \$0.00000. On the contrary, numerous studies have
24 identified avoided transmission and distribution capacity costs associated with
25 distributed energy resources, especially photovoltaics (PV). If the Company is
26 currently limited in its ability to perform this cost-benefit analysis, it can and
27 should rely upon similar studies to determine a reasonable interim value or hire a
28 third party to perform a detailed Duke Carolinas-specific avoided transmission
29 and distribution capacity cost study.

1 **Q. Have avoided transmission and distribution capacity cost studies been**
2 **performed elsewhere?**

3 A. Yes. There are numerous studies related to avoided transmission and distribution
4 capacity costs due to distributed solar PV. While those studies differ across
5 certain variables, they are instructive in that they demonstrate for comparison
6 approximate values for avoided transmission and distribution capacity costs, and
7 demonstrate that those values are greater than \$0.00000 per kWh.

8

9 **Q. What are the findings of those studies with respect to avoided transmission**
10 **and distribution capacity costs?**

11 A. I have summarized the results of ten studies in Exhibit TV-1. Because the ten
12 studies vary in region, regulatory structure, infrastructure ownership structure, and
13 dollar year, it can be difficult to compare the studies directly. In order to provide a
14 sense of magnitude, I have calculated the simple average in those ten studies. The
15 avoided transmission and distribution capacity cost in those studies is \$0.0204 per
16 kWh.

17

18 **Q. In order to calculate avoided transmission and distribution capacity costs,**
19 **must DEC wait while “the penetration of DERs grows on the system?”**
20 **(Witness Snider Rebuttal, page 12, line 3)**

21 A. No. It is common for utilities to forecast future costs using modeling, including
22 costs related to future transmission and distribution needs and costs. The avoided
23 transmission and distribution capacity cost studies referenced in Exhibit TV-1 are
24 prospective, not retrospective.

25

26 **Q. What do you recommend the Commission require with respect to avoided**
27 **transmission and distribution capacity costs?**

28 A. I recommend the Commission do the following:

- 29 1. Require DEC to hire a qualified third party to perform a utility-specific
30 avoided transmission and distribution capacity cost study. This study should
31 include the resources of Duke Energy Carolinas and Duke Energy Progress in

1 both North and South Carolina, should allow for avoided cost calculations
2 specific to distributed PV installations in South Carolina consistent with the
3 NEM program, and should allow for a per-megawatt-hour calculation that
4 complies with the Settlement Agreement approved in Order No. 2015-194.

5 2. Require DEC to use the avoided transmission and distribution capacity costs
6 quantified in the third party study in future dockets in which DER valuation
7 occurs.

8 3. Require DEC to use existing avoided transmission and distribution capacity
9 cost studies as a proxy for DEC avoided transmission and distribution
10 capacity costs until it has completed its DEC-specific study.

11

12 ***Avoided Environmental Costs***

13 **Q. Does Company witness Snider agree that there are avoided environmental**
14 **costs associated with DER generation?**

15 A. Yes. On page 12, lines 10 through 12, Witness Snider states that “all currently
16 known and measurable environmental costs, such as ... avoided environmental
17 reagent costs ... are already included in the value calculations.”

18

19 **Q. What environmental costs does the Company assert that it includes in the**
20 **NEM avoided cost quantification?**

21 A. Company Witness Snider explicitly includes avoided environmental reagent costs
22 (Witness Snider Rebuttal, page 10, lines 17-19). By stating that all of the avoided
23 environmental costs I included in my direct testimony “are accounted for in the
24 Companies’ avoided capacity and energy values,” Witness Snider implicitly
25 includes both coal ash waste and wastewater effluent (Witness Vitolo Direct
26 Testimony, page 12, lines 16 through 18).

1 **Q. If the Company has agreed that there are avoided environmental costs and**
2 **has stated that it has included avoided environmental costs in its DER**
3 **avoided cost calculations, why does the avoided environmental cost category**
4 **include a value of \$0.00000?**

5 A. DEC includes a value of \$0.00000 for avoided environmental costs for two
6 reasons. First, it includes some avoided environmental costs in its avoided energy
7 and avoided generation capacity categories, thereby obscuring these costs.
8 Second, it appears that the Company fails to include some of the avoided
9 environmental costs it purports to include.

10

11 **Q. Should DEC include avoided environmental cost values not covered under**
12 **law or administrative rule?**

13 A. Witness Snider states in his rebuttal testimony on page 11, lines 1 and 2 that
14 “attempting to ascribe avoided cost values to factors not covered under law or
15 administrative rule would be arbitrary at best.” In fact, all measurable
16 environmental costs associated with laws, administrative rules, or any other
17 Company action—whether those costs are operating or capital, fixed or
18 marginal—should be included to the extent that the distributed energy resources
19 reduce utility costs. For example, if a Company’s plans a prudent investment in
20 anticipation of a not-yet-finalized environmental law or rule, and the investment
21 costs are reduced due to distributed energy resources, then the reduction in future
22 cost should appear in this category. That isn’t “arbitrary at best” (Witness Snider
23 Rebuttal, page 11, line 2); that is a fair accounting of costs and avoided costs on
24 behalf of ratepayers.

25

26 **Q. What avoided environmental cost does DEC claim to include but does not, in**
27 **fact, include?**

28 A. DEC does not appear to include the avoided cost associated with deferring capital
29 expenditures related to coal ash in its avoided cost calculations. Company Witness
30 asserts that coal ash costs are included in avoided energy and generation capacity
31 values. Any marginal cost—associated with a megawatt-hour of generation, a ton

1 of coal ash, or any other similar quantity—could be included in an avoided energy
2 calculation.

3 However, marginal cost of coal ash isn't the only cost avoidable due to distributed
4 energy resources. DEC (and Duke Energy Progress) uses landfills to store coal
5 ash. When any of those landfills approach capacity, the Company must make a
6 capital investment in either a lateral expansion of an existing landfill or
7 construction of a new landfill. When distributed energy resources delay that
8 construction or avoid it completely because the coal unit retires before expansion
9 is needed, those distributed energy resources have deferred or avoided a capital
10 cost. That cost deferral is an avoided cost directly associated with distributed
11 energy resources, but it cannot be included in current avoided energy analysis
12 because the associated software models don't take landfill capacity into account
13 nor do they implement the dynamic programming optimization method necessary
14 to include those costs into account when modeling.

15

16 **Q. What do you recommend the Commission require with respect to avoided**
17 **environmental costs?**

18 A. I recommend the following:

- 19 1. As stated earlier, the Commission should require DEC to include all avoided
20 criteria-pollutant environmental costs in the environmental cost category,
21 rather than obscure those environmental costs in the avoided energy category.
- 22 2. The Commission should require DEC to include all avoided non-criteria-
23 pollutant environmental costs in the environmental cost category, rather than
24 obscure those environmental costs in avoided energy or avoided generation
25 capacity categories.
- 26 3. The Commission should require DEC to perform a comprehensive study of all
27 environmental costs incurred or avoided due to DERs. Such a study would be
28 useful both for dockets such as this one as well as integrated resource
29 planning and other Company decision making.

1 *Avoided Line Losses*

2 **Q. Does Mr. Snider believe a new line loss study is appropriate at this time?**

3 A. He does not (Page 12, Line 16).

4

5 **Q. Does Company Witness Snider state any criteria for undertaking a new line**
6 **loss study?**

7 A. He does not. He does, however, suggest on page 12, line 22 that the DEC changes
8 since the last line loss study are “incremental system changes.”

9

10 **Q. What are some reasons to complete a new line loss study?**

11 A. There are a variety of reasons for a company to commission a new or updated line
12 loss study. One reason is that the existing line loss study doesn’t present findings
13 useful for a specific task. In the case of distributed PV generation, the applicable
14 line loss metric is marginal line losses, weighed hourly across the year to coincide
15 with the generation levels of the distributed PV. This study, according to Mr.
16 Snider on page 12, line 19, presents “system average loss factors.” For calculating
17 the value of distributed solar, system average losses across seasons and hours of
18 the day are not adequate.

19 Another reason is joint dispatch. If the fleet of generators in the region begin
20 dispatching in accordance with a different algorithm because of a recent merger,
21 the power flows over specific transmission lines will be different than they would
22 have been pre-merger.

23 Yet another reason is a significant change in the fleet of generators. The
24 construction of a single generation unit or a single retirement’s impact is likely
25 negligible, but if there are a considerable number of retirements or newly built
26 units, it is reasonable to expect that the power flows across the system will be
27 measurably different, thereby changing the line loss profiles.

1 **Q. From what years did the Company collect data to perform its most recent**
2 **line loss study?**

3 A. DEC provided a study dated 2012.³ The study doesn't provide information about
4 when the data used in the study was collected. A reasonable assumption is that the
5 DEC study uses a full year of data, implying that the data must be from operations
6 in 2011 or earlier.

7

8 **Q. Did the report account for the integration of the Duke Energy Carolinas and**
9 **Duke Energy Progress generation, transmission, and distribution resources**
10 **in North and South Carolina?**

11 A. The Duke Energy Corporation – Progress Energy, Inc. merger wasn't approved
12 by the North Carolina Utilities Commission until June 25, 2012.⁴ It is therefore
13 reasonable to presume that the data used in the DEC study was collected before
14 the merger.

15

16 **Q. What impacts would joint generation have on line losses for customers in**
17 **DEC's South Carolina territory?**

18 A. Joint dispatch can achieve cost savings because the most efficient set of
19 generators are used across the (now merged) territories. In other words, individual
20 generators will operate differently in some hours in a merged company, rather
21 than how they would have operated were the merger to have not occurred.

22 In addition to joint dispatch, other changes that could change the line loss values
23 include new generators, the retirement of existing generators, new or upgraded
24 transmission lines, and changes in load shape or size.

³ Duke Energy Carolinas, "Duke Energy – Carolinas, Development of Demand Loss Factors, Summer 2012," Data Response to CCL and SACE Data Request 1-3.

⁴ *North Carolina Utilities Commission*, Docket No. E-2, Sub. 998 and Docket No. E-7, Sub. 986. Available at: <http://www.ncuc.commerce.state.nc.us/merger.pdf>

1 **Q. Can you characterize the changes to the Duke Energy Carolinas generation**
2 **fleet since 2011?**

3 A. The changes have been substantial. In the Carolinas, the Duke and Progress
4 companies have retired 3,294 MW of coal-fired generators and constructed a new
5 825 MW coal-fired generator since the line loss data for the existing line loss
6 study could have been collected.⁵ Duke added five natural gas generators between
7 2011 and 2013, totaling 3,415 MW.⁶ The combined more gas-centric Duke-
8 Progress system operated in 2016 is remarkably different than the two distinct,
9 more coal-centric systems were in 2011. The company's fleet of generators
10 operate differently, and are physically located at different places on the
11 transmission grid, then was the case when the data for the most recent line loss
12 study was collected.

13

14 **Q. What do you recommend the Commission require with respect to line losses?**

15 A. In light of the substantial changes in generation, transmission, and dispatch since
16 the last line loss study, the Commission should require DEC to perform a new line
17 loss study in conjunction with Duke Energy Progress. This study should be
18 designed to serve the requirements of a variety of dockets, including avoided cost,
19 energy efficiency, and NEM Distributed Energy Resource Value studies for both
20 DEC and Duke Energy Progress. Further, it should be developed to specifically
21 determine the marginal avoided line losses due to PV, incorporating the temporal
22 nature of both load and PV generation.

⁵ Duke Energy. "Retired Coal Units and Potential Retirements." Last accessed September 1, 2016.
<https://www.duke-energy.com/about-us/retired-coal-units-potential-retirements.asp>

⁶ Duke Energy. "New Natural Gas Generation Project Overview." Last accessed September 1, 2016.
<https://www.duke-energy.com/about-us/natural-gas-overview.asp>

1 **4. CONCLUSION**

2

3 **Q. Please conclude by summarizing your surrebuttal testimony**
4 **recommendations.**

5 A. My recommendations are:

- 6 1. DEC should include the principle of “completeness” in its overarching NEM
7 principles, and DEC should rely on the “quantifiable” standard for the NEM
8 Methodology calculations rather than one of “known and measurable.”
- 9 2. The Commission should require DEC to list the avoided criteria pollutant
10 costs in the avoided criteria pollutant category.
- 11 3. DEC should hire a qualified third party to perform a utility-specific avoided
12 transmission and distribution capacity cost study, and DEC should use the
13 results from that study in future dockets for DER valuation. Until that study is
14 completed, DEC should use existing avoided transmission and distribution
15 capacity cost studies to quantify DEC’s avoided transmission and distribution
16 capacity.
- 17 4. DEC should include all avoided non-criteria pollutant environmental costs in
18 the environmental cost category, rather than embedding them in avoided
19 energy or avoided generation capacity categories.
- 20 5. DEC should perform a comprehensive study of all environmental costs
21 incurred or avoided due to DERs.
- 22 6. DEC should perform a new line loss study in conjunction with Duke Energy
23 Progress and include the appropriate updated marginal PV-related line loss
24 avoidance results in future DER valuation dockets.

25

26 **Q. Does this conclude your surrebuttal testimony?**

27 A. Yes.

Table 1. Review of Estimates of Transmission and Distribution Avoided Costs

	A	B	E	F	G	H
Row	Study Name	Region	Combined T&D Avoided Costs			Average of Estimates
			Low Estimate	Mid Estimate	High Estimate	
1	2009 APS / RW Beck	AZ	\$0.0000	-	\$0.0082	\$0.0041
2	2008 Navigant	USA	\$0.0010	-	\$0.1000	\$0.0505
3	2012 CPR	NJ/PA	\$0.0010	-	\$0.0060	\$0.0035
4	2013 CPR	TX	\$0.0030	-	\$0.0040	\$0.0035
5	2013 Crossborder	AZ	\$0.0230	-	\$0.0250	\$0.0240
6	2013 SEIC	AZ	-	\$0.0032	-	\$0.0032
7	2014 CPR	MN	-	\$0.0110	-	\$0.0110
8	2014 Synapse	MS	-	\$0.0400	-	\$0.0400
9	2015 NREL	USA	\$0.0000	\$0.0140	\$0.0190	\$0.0110
10	2015 Acadia	MA	\$0.0424	\$0.0519	\$0.0657	\$0.0530
11	Average of studies	-	-	-	-	\$0.0204

Notes: All estimates of costs are measured in dollars per kilowatt-hour (\$/kWh).

All estimates are for fixed (non-tracking) installations.

Estimates are reported using varying dollar-years, levelization periods, and discount rates.

Acadia Average of Estimates averages all five estimates provided in study's findings.

Table 2. Study Citations

Row	Citation
1	R.W. Beck. January 2009. "Distributed Renewable Energy Operating Impacts and Valuation Study." Prepared for Arizona Public Service.
2	Navigant Consulting. February 2008. "Photovoltaics Value Analysis." Prepared for National Renewable Energy Laboratory.
3	Clean Power Research. November 2012. "The Value of Distributed Solar Electric Generation to New Jersey and Pennsylvania." Prepared for Mid-Atlantic Solar Energy Industries Association and Pennsylvania Solar Energy Industries Association.
4	Clean Power Research and Solar San Antonio. March 2013. "The Value of Distributed Solar Electric Generation to San Antonio." Prepared for Solar San Antonio under a Department of Energy SunShot Initiative grant.
5	Crossborder Energy. May 2013. "The Benefits and Costs of Solar Distributed Generation for Arizona Public Service." Prepared for Solar Energy Industries Association.
6	SEIC. May 2013. "2013 Updated Solar PV Value Report." Prepared for Arizona Public Service.
7	Clean Power Research. January 2014. "Minnesota Value of Solar: Methodology." Prepared for Minnesota Department of Commerce, Division of Energy Resources.
8	Synapse Energy Economics. September 2014. "Net Metering in Mississippi: Costs, Benefits, and Policy Considerations." Prepared for the Public Service Commission of Mississippi.
9	National Renewable Energy Laboratory. March 2015. "Value of Solar: Program Design and Implementation Considerations." Prepared under Task No. SM13.1570.
10	Acadia Center. April 2015. "Value of Distributed Generation: Solar PV in Massachusetts." Prepared for Massachusetts Net Metering and Solar Task Force.