PUBLIC SERVICE COMMISSION OF SOUTH CAROLINA

Annual Review of Base Rates for Fuel Costs for Duke Energy Carolinas, LLC	} } } } }	**Docket No. 2018-3-E**

Direct Testimony of Devi Glick

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

On the Topic of Annual Review of Base Rates for Fuel Costs for Duke Energy Carolinas, LLC

August 17, 2018

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1. INTRODUCTION AND QUALIFICATIONS

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

A. My name is Devi Glick. I work at Synapse Energy Economics, Inc., located at 485 Massachusetts Avenue in Cambridge, Massachusetts.

Q. Please describe Synapse Energy Economics.

A. Synapse Energy Economics is a research and consulting firm specializing in electricity and natural gas industry regulation, planning, and analysis. Our work covers a range of issues, including integrated resource planning; economic and technical assessments of energy resources; electricity market modeling and assessment; energy efficiency policies and programs; renewable resource technologies and policies; and climate change strategies. Synapse works for a wide range of clients, including attorneys general, offices of consumer advocates, public utility commissions, environmental advocates, the U.S. Environmental Protection Agency, the U.S. Department of Energy, the U.S. Department of Justice, the Federal Trade Commission, and the National Association of Regulatory Utility Commissioners. Synapse has over 20 professional staff with extensive experience in the electricity industry.

Q. Please summarize your professional and educational experience.

A. I have a master's degree in public policy and a master's degree in environmental science from the University of Michigan; a bachelor's degree in environmental studies from Middlebury College; and more than five years of professional experience as a consultant, researcher, and analyst.

At Synapse and previously at Rocky Mountain Institute, I have focused on a wide range of energy and electricity issues, including: utility resource planning, distributed energy resource valuation, energy efficiency program impact analysis, and rate design effectiveness. For this work, I develop in-house models and perform analysis using industry-standard models.

On topics related to the costs and benefits of distributed generation, I have co-authored two studies reviewing valuation methodologies for solar photovoltaics (PV). These studies have been highly cited in public utility proceedings for their recommendations around distributed energy resource pricing and rate design. Most recently, I evaluated various rate design options for distributed energy resources within the state of Hawaii.

My CV is attached as Exhibit DG-1.

Q. On whose behalf are you testifying in this proceeding?

A. I am testifying on behalf of the South Carolina Coastal Conservation League (CCL) and Southern Alliance for Clean Energy (SACE).

Q. Have you testified previously before the South Carolina Public Service Commission ("the Commission")?

A. Yes. I testified on behalf of CCL and SACE in Duke Energy Progress and South Carolina Electric & Gas Company's most recent annual fuel cost proceedings, Commission Docket Numbers 2018-1-E and 2018-2-E, respectively.

Q. What is the purpose of your direct testimony in this proceeding?

A. Each year, Duke Energy Carolinas, LLC (DEC or the Company) updates its value of Net Energy Metering (NEM) Distributed Energy Resources (DER) methodology. As a practical matter, most of the net metered DERs in South Carolina are rooftop solar photovoltaic (PV) systems. This value of NEM DER influences the calculation of DER program costs that are collected from ratepayers, so it is important to seek an accurate valuation. If the value is too low, then the Company is understating the value that DER provides to its system and therefore overcollecting incremental DER program costs from its customers. If the value is too high, then the Company is overstating the value DERs provide to its system and therefore undercollecting incremental DER program costs from its customers.

The purpose of my testimony is to provide input on DEC's 2018 value of NEM DER update. In particular, my testimony demonstrates that DEC is undervaluing NEM DERs like rooftop solar power. The result of undervaluing NEM DERs is that the Company is likely overcollecting NEM DER program costs from customers because they are not accounting for the full value provided to the grid and its customers from NEM DERs like rooftop solar. DEC includes zero values for most of the NEM DER Methodology components for 2018. My testimony focuses on providing input on how to proceed with filling in several of these components within the NEM Methodology. Note that the fact that I have not addressed each of the zero value components does not mean that I agree that zero is the appropriate value.

Q. How is the remainder of your testimony organized?

A. My testimony is organized as follows:

1. Introduction and Qualifications
2. Summary of Conclusions and Recommendations
3. Background on the NEM and Fuel Cost Calculations
4. Net Energy Metering Methodology – 2018 Application

Q. Are you sponsoring any exhibits?

A. Yes. I am sponsoring the following exhibits:

- DG-1: Resume of Devi Glick,
- DG-2: NEM DER valuation Methodology and component descriptions from SC Public Service Commission Docket 2014-246-E
- DG-3: Avoided Transmission Capacity Calculation.
- DG-4: Avoided Environmental Costs Related to Coal Ash Calculation (Public and Confidential versions).

2. SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS

Q. Please summarize your primary conclusions.

A. My primary conclusions, discussed and supported in greater detail below, are summarized as follows:

1. It is possible to quantify avoided transmission and distribution costs and those avoided costs are non-zero, therefore DEC should no longer be permitted to use a placeholder value of zero in the transmission and distribution (T&D) capacity category.

2. It is possible to quantify the avoided environmental cost of coal ash disposal as it relates to distributed PV, therefore DEC should no longer be permitted to use a placeholder value of zero in the Environmental Costs category.

Q. Please summarize your primary recommendations.

1. The Commission should require DEC to immediately adopt an avoided T&D Capacity value of $0.005028/kWh based on the Current Values approach described below.

2. The Commission should require DEC to conduct a detailed distribution system study to better understand the impact that NEM DERs have on the distribution system and to quantify the avoided cost associated with distribution capacity.

3. The Commission should require DEC to immediately adopt an avoided Environmental Cost of $0.00002/kWh based on the cost of avoided coal ash landfill capacity.

3. BACKGROUND ON THE NEM AND FUEL COST CALCULATIONS

Q. Did DEC calculate a value for each component of NEM Methodology?

A. No, DEC did not. DEC assigned a value of zero to seven of the eleven components of NEM, several of which are reasonably quantifiable at this time. My testimony focuses on providing value recommendations for the following two categories: 1) transmission and distribution cost deferral and 2) avoided environmental costs.

For reference, a copy of the original NEM DER valuation Methodology and component descriptions from SC Public Service Commission Docket 2014-246-E is attached as Exhibit DG-2. Below is a table reflecting the Company's proposed 2018 update to the value of NEM DER as reported by Company Witness Snider in his direct testimony at page 4 and Table 1.

Table 1: DEC's Proposed 2018 Value of NEM DER

Components of NEM DER value	Component Value ($/kWh) Small PV	Component Value ($/kWh) Large PV
Avoided Energy Costs	$0.036689	$0.036670
Avoided Capacity Costs	$0.014212	$0.014106
Ancillary Services	$0	$0
T&D Capacity	$0	$0
Avoided Criteria Pollutants	$0.000034	$0.000033
Avoided CO2 Emissions Costs	$0	$0
Fuel Hedge	$0	$0
Utility Integration & Interconnection Costs	$0	$0
Utility Administrative Cost	$0	$0
Environmental Costs	$0	$0
Subtotal	$0.050935	$0.050809
Marginal Line Losses	$0.002296	$0.002289
Total Value of DER	$0.05323	$0.05310

Q. Is DEC required to calculate a value for each NEM component or can it continue to use a value of zero as a placeholder?

A. DEC must calculate values for several components that it has previously valued at zero because they are reasonably quantifiable at this time. In the 2014 Settlement Agreement to Docket No. 2014-246-E, the parties agreed that:

> The Methodology includes all categories of potential costs of benefits to the Utility system that are capable of quantification or possible quantification in the future. Where there is currently a lack of capability to accurately quantify a particular category and/or a lack of cost of benefit to the Utility system the category has been included in the Methodology as a placeholder . . . **Placeholder categories will be updated and included in the calculation of costs and benefits of net metering if and when capabilities to reasonably quantify those values and quantifiable costs or benefits to the Utility system in such categories become available.**[1]

There exists currently the capability to quantify the value of avoided transmission capacity, and avoided environmental costs, therefore DEC is required to calculate these avoided costs—which are benefits of NEM DERs like rooftop solar—and include them in the value of NEM DERs.

4. NET ENERGY METERING METHODOLOGY – 2018 APPLICATION

Transmission and Distribution Capacity Costs

Q. Has DEC included a value associated with avoided Transmission and Distribution Capacity Costs?

A. DEC included a zero value (Witness Snider Testimony, page 4, table 1) for avoided transmission and distribution (T&D) capacity, for both Small and Large PV.

[1] SC PSC Docket No. 2014-246-E Settlement Agreement, at p. 4, para. III.8. Available at https://dms.psc.sc.gov/Attachments/Matter/46a1fee8-155d-141f-233230a670190eb2.

Q. Is a zero value appropriate for the avoided T&D Capacity cost component?

A. No. First, it is possible to reasonably quantify the value and ability of NEM DERs like rooftop solar to avoid or defer transmission and distribution system capacity costs, therefore there is no longer adequate justification to use a placeholder value for the avoided T&D component.

Additionally, system operators across the country incorporate NEM DERs like solar PV into their transmission system planning process, and explicitly credit and acknowledge that distributed solar PV reduces transmission system spending. For example:

- During its 2015-2016 planning process, CAISO credited the combination of rooftop solar and energy efficiency with avoiding the need for $200 million in transmission updates. [2]
- During its 2017-2018 planning process, CAISO canceled 19 transmission projects and revised 21 others, resulting in new savings of $2.6 billion.[3]
- PJM incorporates distributed solar forecasts into its regional transmission planning process.[4]

These examples demonstrate the real and tangible value of DERs like solar PV in avoiding transmission capacity.

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[2] Julia Piper. Greentech Media. "Californians Just Saved $192 Million Thanks to Efficiency and Rooftop Solar," May 31, 2016. Available at https://www.greentechmedia.com/articles/read/californians-just-saved-192-million-thanks-to-efficiency-and-rooftop-solar.

[3] Piper, Greentech Media.

[4] PJM. 2017 Regional Transmission Expansion Plan, Book 2: Inputs and Processes. Available at https://www.pjm.com/library/reports-notices/rtep-documents.aspx.

Q. Have other utilities adopted non-zero values for avoided Transmission and Distribution Capacity cost component?

A. Yes. In 2013 I reviewed 15 studies for Rocky Mountain Institute's "A Review of Solar PV Benefits & Costs Studies, 2nd Edition."[5] This study has been previously filed with the Commission in Docket No. 2018-2-E.

Twelve of the reviewed studies included a Transmission and Distribution benefit within the avoided cost categories. All 12 included a non-zero avoided cost for the Transmission and Distribution benefit. For example, Crossborder Energy found an avoided Transmission and Distribution capacity value of around $0.025/kWh for Arizona Public Service and $0.015/kWh for California. Since that time, many more value of solar studies have been conducted and included a non-zero value for avoided transmission or distribution capacity.

Q. What factors drive the value of avoided Transmission & Distribution capacity investments?

A. The value of avoided transmission and distribution capacity investments are driven mainly by the following factors:[6]

- Load growth – Is customer demand for electricity growing or falling? Is the timing of demand changing?
- Distributed solar configuration and energy production – How is the solar oriented? How much energy does it produce and during which hours?
- Peak coincidence – How well does the generation from the distributed solar align with the system peak? With feeder peak?
- Effective capacity – How much firm capacity can the distributed solar be expected to provide during the peak hour (in both the summer and winter)?

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[5] Hansen, L, Lacy, V, and Glick, D. 2013. *A Review of Solar PV Benefit and Cost Studies.* Rocky Mountain Institute. This study is available at https://rmi.org/wp-content/uploads/2017/05/RMI_Document_Repository_Public-Reprts_eLab-DER-Benefit-Cost-Deck_2nd_Edition131015.pdf

[6] Hansen, Lacy and Glick, 2013

Q. Do DERs like solar PV affect the transmission system and the distribution system in the same manner?

A. No. Distributed rooftop solar PV in particular is connected at or near where the electricity is needed. Excess electricity produced by rooftop solar will flow back onto the distribution system, resulting in a net impact that is very location specific based on the alignment of PV generation and local load.[7]

In contrast, the transmission system aggregates many different distribution areas and is impacted by the *total* amount of distributed solar on the aggregated system. With increased distributed solar investment, less electricity is demanded from the central generators. As a result, the transmission system will experience a decrease in load identical to what the system would experience with increased demand-side energy efficiency deployment.

Q. Are the values for avoided transmission and avoided distribution capacity calculated using the same methodology?

A. No they are not. Because distribution system impacts are very location specific, they must be calculated using a detailed distribution system study. With significant quantities of distributed solar PV, some feeders and lines on the distribution system may experience increased load from distributed solar PV, but the typical outcome is congestion relief and decreased flow. It is hard to estimate net distribution system impacts without detailed, location-specific information.

Transmission system impacts are also most accurately calculated using a detailed transmission system study. However, because distributed solar PV does not directly flow back onto the transmission system, the impacts can be reasonably quantified based on the total amount of PV on the system.

[7] Hansen, Lacy and Glick, 2013.

Q. What approaches have other utilities taken to calculate the value of avoided transmission and distribution capacity costs?

A. Utilities have taken several different approaches to valuing avoided transmission and avoided distribution costs. Below is a sample of methodologies that utilities have used to quantify the value of avoided transmission or avoided distribution costs:

<u>Maine's Value of Solar study, Clean Power Research (CPR)</u>

For this study, CPR used historical transmission tariffs as a proxy for the cost of future transmission that is avoidable or deferrable through the use of distributed generation (DG). Maine is part of ISO-New England, and pays a transmission tariff (ISO-NE Open Access Transmission Tariff (OATT)) on a per-KW demand charge that is a function of monthly system peak for transmission service. "Avoided costs are estimated by determining the savings to the distribution utility that would result from a reduction of monthly peak demands and the resulting reduction in network load allocation."[8]

<u>MidAmerican Energy Company, Demand Side Management Filings</u>

MidAmerican took a simplified Current Values approach. It calculated the average cost to serve existing load by dividing both the transmission and distribution system net cost by the systems peak capability. MidAmerican used publicly available FERC Form 1 data on original cost of plant less accumulated depreciation, load data and generation capability data to estimate the $/kW cost for each system.[9]

<u>PacifiCorp IRPs</u>

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[8] Clean Power Research, *Maine Public Utilities Commission, Distributed Solar Valuation Study*. April, 2015.

[9] "Direct Testimony of Jennifer L. Long," Application for Approval of Energy Efficiency Plan for 2014-2018 (Docket EEP-2012-0002), Submitted to Iowa Public Utilities Board by MidAmerican Energy Company, Feb. 1, 2013, p. 4. Note that MidAmerican modified its approach to incorporate on peak load data instead of generation capability data.

PacifiCorp used a cost of service study to estimate the value of avoided transmission and distribution credits for its Integrated Resource Plan (IRP) in Oregon, Washington, Idaho, California, Wyoming, and Utah. PacifiCorp estimated the demand-related substation costs by looking at substation capacity investment for the next five years, dividing that investment by total increased capacity in kVA, and annualizing the result. PacifiCorp did the same for transmission costs, dividing total growth-related transmission investment over the next five years by forecasted change in peak, and annualizing the result.[10]

Q. What approaches should DEC consider to calculate the value of avoided distribution capacity? Please explain each in detail, including the advantages and disadvantages of each.

A. There are several potential approaches that DEC can take.

<u>System Planning Study</u>

DEC could do a systems planning study that takes an in-depth forward-look at the utility's forecasted load and distribution plans.[11] The utility would model the distribution system with and without incremental blocks of distributed solar PV (or alternatively with decreased load). DEC could then compare the present value of the original distribution investment plan and the deferred or avoided distribution investments. This approach is the most accurate, but also the most time intensive and costly to conduct. It also requires full information on the company's distribution systems, generators and load, as well as modeling software that is capable of representing system operation and capacity expansion.

<u>Review of Historical Distribution Spending</u>

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[10] The Mendota Group, LLC. *Benchmarking Transmission and Distribution Costs Avoided by Energy Efficiency Investments, for Public Service Company of Colorado.* October, 2014, pages 8-9. This study was included as an exhibit to my Direct Testimony in Docket 2018-1-E and can be accessed here: https://dms.psc.sc.gov/Attachments/Matter/0a56d8ac-5a54-4942-ad2d-cb3082981ac6.

[11] The Mendota Group, LLC. *Benchmarking Transmission and Distribution Costs Avoided by Energy Efficiency Investments, for Public Service Company of Colorado.* October, 2014, page 6.

Absent a full system plan, DEC can review prior distribution spending and identify which projects were deferrable due to solar PV.[12] A retrospective review of prior spending requires access to, and knowledge of all projects and spending on the distribution system over a period of years sufficient to display normal investment. Investments would be broken down into two categories: upgrades required due to load growth, and upgrades not related to load growth. Upgrades required to meet load growth could be considered avoidable. This approach is less accurate than a full in-depth model and still requires full access to the Company's distribution plans and a technical understanding of which types of projects are driven by load growth and which are not.

Q. What approaches should DEC consider to calculate the value of avoided transmission capacity? Please explain each in detail, including the advantages and disadvantages of each.

A. A Systems Planning Study or Review of Historical Transmission Spending can be undertaken for the transmission system in the same manner as outlined above for the distribution system. In addition, two simplified approaches can be used to estimate the avoided cost of transmission capacity when more detailed information is not available.

<u>Statistical Correlation of Transmission Capital Investment and Forecasted Load Growth</u>

DEC can estimate the avoided cost of transmission spending based on statistical analysis of the correlation between transmission spending and forecasted load growth. This approach evaluates how much transmission spending can be deferred or avoided by solar PV, and how much spending is independent of load growth and is not impacted by solar PV. This methodology is less accurate than the in-depth study and the retrospective review, but only requires utility data on transmission investment broken down by the year in which projects came online.

[12] The Mendota Group, LLC. *Benchmarking Transmission and Distribution Costs Avoided by Energy Efficiency Investments, for Public Service Company of Colorado.* October, 2014, page 8.

Estimates can be performed with publicly available forecasts on load growth and FERC Form 1 data on transmission spending when detailed utility data is not provided.

Current Values Approach

The Current Values approach uses publicly available data on transmission system investments to calculate an average avoided cost. Specifically, FERC Form 1 data on original cost of plant less accumulated depreciation is divided by peak system capability to provide the $/kW cost for each system.

Q. Have you calculated a value for avoided transmission or distribution capacity on DEC's system? If yes, which approach did you use?

A. Yes, I have. I used the Current Values approach to estimate which transmission spending was correlated with load growth and could be deferred or avoided through distributed solar PV. DEC has not conducted a detailed distribution system study, therefore I have not been able to calculate the value of avoided distribution capacity.[13]

Q. How would you recommend the Commission proceed with respect to determining a company- and state-specific avoided T&D component value?

A. If DEC's system is summer peaking, the avoided transmission capacity value is $0.046259/kWh (Exhibit DG-3, Row 10). If, on the other hand, DEC's system is dual peaking, the avoided transmission capacity value is the smaller of the two seasonal values, $0.005028/kWh (Exhibit DG-3, Row 11). Because DEC currently purports to be dual peaking, I recommend that the Commission immediately adopt the duel peaking value of $0.005028/kWh. As DEC focuses on deploying cost-effective winter-time demand-side management, it is reasonable to

[13] At the time of this filing, the Company has provided distribution data for just the past three years and with transmission data for a longer period (since 2000), but for only some transmission projects (new line and reconductor projects).

expect that the system will return to summer peaking.[14] At that time, a summer-only value for avoided transmission capacity should be used should be used.

In order the calculate the value of avoided distribution capacity, I recommend that the Commission require DEC to conduct a detailed distribution system study.

Q. How did you arrive at your recommended avoided transmission component value?

A. I arrived at the $0.005028/kWh value for avoided transmission capacity by using the Current Values approach using publicly available FERC Form 1 data (Exhibit DG-4). The Current Values approach calculates the current value of the transmission system per kW of transmission peak use. This value represents the cost of serving an additional kW, or conversely the savings from avoiding additional transmission need.

When using this method to calculate avoided transmission capacity associated with solar PV, it is important to weigh the avoided transmission capacity value by solar PV's system capacity credit. To represent the avoided transmission capacity value on a $/kWh basis, the avoided cost must be divided by the expected energy production of the incremental solar PV. These steps have been incorporated into my calculation.

Environmental Costs

Q. How has DEC presented the 2018 value associated with avoided Environmental Costs?

A. DEC represented the value as $0.0000 (Witness Snider, Page 4, Table 1).

[14] The Commission recently encouraged this approach in South Carolina Electric & Gas Company's fuel cost proceeding, directing the Company to "take all appropriate measures to aggressively pursue economic demand side management and energy efficiency programs, targeted at reducing the winter peak." Docket 2018-2-E, Order 2018-322(A).

Q. Please comment on DEC's use of a zero value for the Environmental Costs Component.

A. As with the avoided T&D Capacity component, this value is reasonably quantifiable and should not be listed as zero.

Q. Why is a zero value inappropriate for the Environmental Cost component?

A. There are many environmental costs that can be avoided through the decreased use of conventional combustion technologies such as coal, oil, and natural gas. Some, like criteria pollutant costs, have been reported as a separate component by DEC. Other costs, such as the capital costs related to management and disposal of waste and wastewater produced by coal-generators, are substantial but their avoidance have not yet been included.

Q. What other costs do you believe should be included in DEC's calculation of avoided Environmental Costs at this time?

A. I believe that the cost of coal ash disposal should be included as an avoided environmental cost. DEC's coal-fired power plants, as well as the coal-fired power plants owned by Duke Energy Progress, LLC that are dispatched for the benefit of DEC customers,[15] generate large quantities of coal ash waste. This waste is regulated under the U.S. EPA's recently revised Coal Combustion Residuals (CCR) rule, as well as by the North Carolina Coal Ash Bill.[16] There are three broad categories of costs associated with coal ash waste:

1) Variable operational costs associated with coal ash disposal for each kWh of coal-fired generation.

2) Capital costs associated with building new impoundments. As coal ash impoundments fill up, new ones may be constructed.

[15] SC PSC Docket Nos. 2011-158-E and 2011-68-E Settlement Agreement. Available at http://www.regulatorystaff.sc.gov/Documents/News%20Archives/DukeProgressSettlement.pdf.

[16] 2014 N.C. Sess, Laws 122; 2014 N.C. Ch. 122; 2013 N.C. SB 729.

3) Costs associated with the risk that an impoundment will leak and that leak will require clean up.[17]

Therefore, to the extent that NEM distributed energy resources reduce the dispatch of coal units, those NEM resources are allowing the Company to avoid the environmental costs associated with coal ash waste.

Q. How would you value the avoided Environmental Costs associated with coal ash waste?

A. NEM distributed energy resources allow for the utility to burn less coal, and therefore allow coal ash landfills and impoundments to fill less quickly. For every kWh of NEM DERs like rooftop solar that is used in place of coal, coal ash production is avoided, and therefore the distributed solar PV avoids or postpones the need for new coal ash landfills. This has an economic value that is attributable to NEM resources and should be quantified and included in the DEC's calculations.

Q. Are you able to quantify this value of avoided coal ash costs?

Yes, I have calculated this value at $0.00002/kWh.

Q. How did you arrive at your recommended value for the avoided Environmental Costs associated with coal ash landfill capacity?

DEC plans to build two new coal ash landfills over the next five years at Cliffside and Marshall to replace existing landfills that are projected to be full by 2023 and 2025.

Distributed solar PV has the ability to delay or displace the need to build these landfills.

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[17] These risks and costs were laid out in the "Regulatory Impact Analysis: EPA's 2018 RCRA Proposed Rule Disposal of Coal Combustion Residuals from Electric Utilities; Amendments to the National Minimum Criteria (Phase One). March, 2018."

To calculate the avoided cost of coal ash disposal landfills, I determined the amount of coal ash that would be avoided if solar displaced coal generation on the margin, and then calculated the associated incremental capital cost.

To use this method it was important to have historic data on: 1) The capital cost of the coal ash landfills, 2) electricity generation at each associated coal unit in the time since the landfill was constructed, 3) the amount of coal ash that has been deposited in the landfill over this same time period, 4) the date when the landfill is expected to be full; and 5) the number of hours during a year when coal is on the margin during daytime (when the sun is shining). All of these values have been incorporated into my calculation, which is supported by Exhibit DG-4.[18]

Q. Is there anything else regarding DEC's value of NEM DER calculations that you want to comment on?

A. Yes, two comments. First, I have calculated the value associated with deferred or avoided coal ash disposal landfills. To the extent that there are also coal ash handling or management costs that can be avoided by NEM DERs, those should also be separately reported by the Company and incorporated into the NEM DER valuation update.

Second, regarding line losses, I want to highlight that DEC has utilized a methodology that relied on marginal and not average losses in calculating the avoided cost of line losses. This approach is consistent with the NEM Methodology Settlement Agreement from 2014, which states that "marginal loss data is more appropriate [than average loss data] and should be used when available."[19] The line losses methodology has been discussed in other dockets, notably the DEP docket, where we recommended that DEP be required to utilize a marginal approach in place of its current average methodology.

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[18] The exhibit calculates only the avoided cost associated with the units where DEC has indicated it plans to build new coal ash landfills over the next ten years.

[19] *See* Exhibit DG-2 (describing the energy losses/line losses component).

5. CONCLUSION

Q. Please summarize your recommendations regarding the net energy metering methodology—2018 application.

A. My recommendations are:

1. The Commission should require DEC to immediately adopt an avoided T&D value of $0.005028/kWh based on the value of avoided transmission capacity calculated above.

2. The Commission should require DEC to conduct a detailed distribution system study to better understand the impact that NEM DERs have on the distribution system and to quantify the avoided cost associated with distribution capacity.

3. The Commission should require DEC to immediately adopt an avoided Environmental Cost of $0.00002 based on the valuation method described above.

Q. Does this conclude your testimony?

A. Yes.

Devi Glick, Associate

Synapse Energy Economics I 485 Massachusetts Avenue, Suite 2 I Cambridge, MA 02139
dglick@synapse-energy.com

PROFESSIONAL EXPERIENCE

Synapse Energy Economics Inc., Cambridge, MA. *Associate*, January 2018 – Present

Conducts research and provides consulting on energy sector issues. Examples include:

- modeling for resource planning using PLEXOS utility planning software, analysis of system-level cost impacts of energy efficiency nationwide;
- rate design for distributed energy resources within the state of Hawaii; and
- developing a manual and providing quality control for a tool to analyze the impacts of climate measures and energy policies in Morocco.

Rocky Mountain Institute, Basalt, CO. August 2012 – September 2017

Senior Associate

- Led technical analysis, modeling, training and capacity building work for utilities and governments in Sub-Saharan Africa around integrated resource planning for the central electricity grid energy and identified over a billion dollars in savings based on improved resource-planning processes.
- Represented RMI as a content expert and presented materials on electricity pricing and rate design at conferences and events.
- Led a project to research and evaluate utility resource planning and spending processes, focusing specifically on integrated resource planning, to highlight systematic overspending on conventional resources and underinvestment and underutilization of distributed energy resources as a least-cost alternative.

Associate

- Led modeling analysis in collaboration with NextGen Climate America which identified a CO_2 loophole in the Clean Power Plan of 250 million tons, or 41 percent of EPA projected abatement, and was submitted as an official federal comment, and led to a modification to address the loophole in the final rule.
- Led financial and economic modeling in collaboration with a major U.S. utility to quantify the impact that solar PV would have on their sales, and helped them identify alternative business models that would allow them to recapture a significant portion of this at-risk value.

- Supported the planning, content development, facilitation, and execution of numerous events and workshops with participants from across the electricity sector for RMI's Electricity Innovation Lab (eLab) initiative.
- Co-authored two studies reviewing valuation methodologies for solar PV and laying out new principles and recommendations around pricing and rate design for a distributed energy future in the United States. These studies have been highly cited by the industry and submitted as evidence in numerous Public Utility Commission rate cases.

The University of Michigan, Ann Arbor, MI. *Graduate Student Instructor*, September 2011 – July 2012

Prepared lesson plans, taught classes, graded papers and other coursework, met regularly with students.

The Virginia Sea Grant at the Virginia Institute of Marine Science, Gloucester Point, VA. *Policy Intern*, Summer 2011

Managed a communication network analysis study of coastal resource management stakeholders on the Eastern Shore of the Delmarva Peninsula.

The Commission for Environmental Cooperation (NAFTA), Montreal, QC. *Short Term Educational Program/Intern*, Summer 2010

Researched energy and climate issues relevant to the NAFTA parties to assist the executive director in conducting a GAP analysis of emission monitoring, reporting, and verification systems in North America.

Congressman Tom Allen, Portland, ME. *Technology Systems and Outreach Coordinator*, August 2007 – December 2008

Directed Congressman Allen's technology operation, responded to constituent requests, and represented the Congressman at events throughout southern Maine.

EDUCATION

The University of Michigan, Ann Arbor, MI
Master of Public Policy, Gerald R. Ford School of Public Policy, 2012
Master of Science, School of Natural Resources and the Environment, 2012
Masters Project: *Climate Change Adaptation Planning in U.S. Cities*

Middlebury College, Middlebury, VT
Bachelor of Arts, 2007
Environmental Studies, Policy Focus; Minor in Spanish
Thesis: *Environmental Security in a Changing National Security Environment: Reconciling Divergent Policy Interests, Cold War to Present*

PUBLICATIONS

Fagan, B., R. Wilson, S. Fields, D. Glick, D. White. 2018. *Nova Scotia Power Inc. Thermal Generation Utilization and Optimization: Economic Analysis of Retention of Fossil-Fueled Thermal Fleet To and Beyond 2030 – M08059*. Prepared for Board Counsel to the Nova Scotia Utility Review Board.

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Lashof, D. A., D. Weiskopf, D. Glick. 2014. *Potential Emission Leakage Under the Clean Power Plan and a Proposed Solution: A Comment to the US EP*A. NextGen Climate America.

Smith, O., M. Lehrman, D. Glick. 2014. *Rate Design for the Distribution Edge*. Rocky Mountain Institute.

Hansen, L., V. Lacy, D.Glick. 2013. *A Review of Solar PV Benefit & Cost Studies*. Rocky Mountain Institute.

TESTIMONY

Public Service Commission of South Carolina (Docket No. 2018-2-E): Direct testimony of Devi Glick on avoided cost calculations and the costs and benefits of solar net energy metering. On behalf of South Carolina Coastal Conservation League and Southern Alliance for Clean Energy. April 12, 2018.

Public Service Commission of South Carolina (Docket No. 2018-2-E): Surrebuttal testimony of Devi Glick on avoided cost calculations and the costs and benefits of solar net energy metering. On behalf of South Carolina Coastal Conservation League and Southern Alliance for Clean Energy. April 4, 2018.

Resume updated May 2018

Settlement Agreement Attachment A

Net Energy Metering ("NEM") Methodology

+/- Avoided Energy
+/- Energy Losses/Line Losses
+/- Avoided Capacity
+/- Ancillary Services
+/- Transmission and Distribution ("T&D") Capacity
+/- Avoided Criteria Pollutants
+/- Avoided CO_2 Emission Cost
+/- Fuel Hedge
+/- Utility Integration & Interconnection Costs
+/- Utility Administration Costs
+/- Environmental Costs
= **Total Value of NEM Distributed Energy Resource**

The following table details the components of the Methodology.

Methodology Component	Description	Calculation Methodology/Value
+/- Avoided Energy	Increase/reduction in variable costs to the Utility from conventional energy sources, i.e. fuel use and power plant operations, associated with the adoption of NEM.	Component is the marginal value of energy derived from production simulation runs per the Utility's most recent Integrated Resource Planning ("IRP") study and/or Public Utility Regulatory Policy Act ("PURPA") Avoided Cost formulation.
+/- Energy Losses/Line Losses	Increase/reduction of electricity losses by the Utility from the points of generation to the points of delivery associated with the adoption of NEM.	Component is the generation, transmission, and distribution loss factors from either the Utility's most recent cost of service study or its approved Tariffs. Average loss factors are more readily available, but marginal loss data is more appropriate and should be used when available.
+/- Avoided Capacity	Increase/reduction in the fixed costs to the Utility of building and maintaining new conventional generation resources associated with the adoption of NEM.	Component is the forecast of marginal capacity costs derived from the Utility's most recent IRP and/or PURPA Avoided Cost formulation. These capacity costs should be adjusted for the appropriate energy losses.
+/- Ancillary Services	Increase/reduction of the costs of services for the Utility such as operating reserves, voltage control, and frequency regulation needed for grid stability associated with the adoption of NEM.	Component includes the increase/decrease in the cost of each Utility's providing or procurement of services, whether services are based on variable load requirements and/or based on a fixed/static requirement, i.e. determined by an N-1 contingency. It also includes the cost of future NEM technologies like "smart inverters" if such technologies can provide services like VAR support, etc.

Methodology Component	Description	Calculation Methodology/Value
+/- T&D Capacity	Increase/reduction of costs to the Utility associated with expanding, replacing and/or upgrading transmission and/or distribution capacity associated with the adoption of NEM.	Marginal T&D distribution costs will need to be determined to expand, replace, and/or upgrade capacity on each Utility's system. Due to the nature of NEM generation, this analysis will be highly locational as some distribution feeders may or may not be aligned with the NEM generation profile although they may be more aligned with the transmission system profile/peak. These capacity costs should be adjusted for the appropriate energy losses.
+/- Avoided Criteria Pollutants	Increase/reduction of SOx, NOx, and PM10 emission costs to the Utility due to increase/reduction in production from the Utility's marginal generating resources associated with the adoption of NEM generation if not already included in the Avoided Energy component.	The costs of these criteria pollutants are most likely already accounted for in the Avoided Energy Component, but, if not, they should be accounted for separately. The Avoided Energy component must specify if these are included.
+/- Avoided CO_2 Emissions Cost	Increase/reduction of CO_2 emissions due to increase/reduction in production from each Utility's marginal generating resources associated with the adoption of NEM generation.	The cost of CO_2 emissions may be included in the Avoided Energy Component, but, if not, they should be accounted for separately. A zero monetary value will be used until state or federal laws or regulations result in an avoidable cost on Utility systems for these emissions.
+/- Fuel Hedge	Increase/reduction in administrative costs to the Utility of locking in future price of fuel associated with the adoption of NEM.	Component includes the increases/decreases in administrative costs of any Utility's current fuel hedging program as a result of NEM adoption and the cost or benefit associated with serving a portion of its load with a resource that has less volatility due to fuel costs than certain fossil fuels. This value does not include commodity gains or losses and may currently be zero.
+/- Utility Integration & Interconnection Costs	Increase/reduction of costs borne by each Utility to interconnect and integrate NEM.	Costs can be determined most easily by detailed studies and/or literature reviews that have examined the costs of integration and interconnection associated with the adoption of NEM. Appropriate levels of photovoltaic penetration increases in South Carolina should be included.
+/- Utility Administration Costs	Increase/reduction of costs borne by each Utility to administer NEM.	Component includes the incremental costs associated with net metering, such as hand billing of net metering customers and other administrative costs.
+/- Environmental Costs	Increase/reduction of environmental compliance and/or system costs to the Utility.	The environmental compliance and/or Utility system costs might be accounted for in the Avoided Energy component, but, if not, should be accounted for separately. The Avoided Energy component must specify if these are included. These environmental compliance and/ or Utility system costs must be quantifiable and not based on estimates.

Avoided Transmission Capacity Calculation

Row		Value	Source
1	Tx Peak (MW)	23,622	2016 FERC Form 1
2	Peak (MW)	18,022	2016 FERC Form 1
3	Tx Year End Balance ($)	3,568,696,873	2016 FERC Form 1
4	Depreciation ($)	71,186,690	2016 FERC Form 1
5	Net Tx Year End Balance ($)	3,497,510,183	Row3 - Row4
6	Net Tx Balance ($/kW)	148.06	(Row5 / Row3) / 1000
7	Solar Summer Capacity Credit	46%	DEC 2017 IRP p 22
8	Solar Winter Capacity Credit	5%	DEC 2017 IRP p 22
9	Estimated Solar Capacity Factor	16.8%	PV Watts, Florence, SC
10	Summer Avoided Tx Value due to PV ($/kWh)	0.046259	(Row6 x Row7)/(8760 x Row9)
11	Winter Avoided Tx Value due to PV ($/kWh)	0.005028	(Row6 x Row8)/(8760 x Row9)

Avoided Environmental Costs Related to Coal Ash Calculation - PUBLIC Version (redacted)

Exhibit DG-4

Row		Cliffside	Marshall	Total	Source
1	Capital Expenditures on Coal Ash Landfills Since 2010	[redacted]	[redacted]	[redacted]	Supplemental Discovery Response to CCL/SACE 1-10f
2	Estimated Closure Date of Existing Coal Ash Landfills	May 2023	April 2025		Discovery Response to CCL/SACE 1-10k
3	Life of Current Coal Ash Landfills	13 years, 5 months	15 years, 4 months		Calculated based on Discovery Response to CCL/SACE 1-10f and 1-10k
4	Historic Generation (2010 - 2017) (MWh)	27,652,311	80,869,307	108,521,618	2010 - 2017 EIA Form 923
5	Average Annual Generation (MWh)	4,029,512	9,769,726	13,799,238	Annual Average of Row 4
6	Estimated Generation (2010 - Landfill Closure Date) (MWh)	54,062,614	149,802,467	203,865,081	Row 5 x Row 3
7	Total Annual Daytime Hours Coal is on the Margin (%)			[redacted]	Calculated from Discovery Response to CCL/SACE 1-9
8	Annual Avoided Coal Ash Landfill Cost ($/kWh)			$0.000022	((Row 1 / Row 6) x Row 7) / (1000 kWh/MWh)