STATE OF NORTH CAROLINA
UTILITIES COMMISSION
RALEIGH

DOCKET NO. E 100, SUB 140

BEFORE THE NORTH CAROLINA UTILITIES COMMISSION

In the Matter of	
Biennial Determination of Avoided Cost)	DIRECT TESTIMONY
Rates for Electric Utility Purchases from)	OF NANCY LAPLACA
Qualifying Facilities – 2014)	ON BEHALF OF NC WARN

Q. PLEASE STATE YOUR NAME AND ADDRESS FOR THE RECORD.

A. My name is Nancy LaPlaca, and my business address is 1739 East 22nd Avenue, #11, Denver CO 80205.

Q. BY WHOM ARE YOU EMPLOYED AND IN WHAT CAPACITY?

A. I am Principal of LaPlaca & Associates LLC. In that capacity, I provide technical assistance to a variety of state agencies and consumer organizations on net metering, renewable energy, avoided cost, resource planning, coal compliance, transmission and energy efficiency dockets. In the present docket I am appearing on behalf of the North Carolina Waste Awareness and Reduction Network ("NC WARN").

Q. PLEASE DESCRIBE YOUR PROFESSIONAL BACKGROUND.

A. For four years I served as Policy Advisor to Paul Newman, an elected Arizona Commissioner, and have been a party in a dozen dockets at the Colorado Public Utilities Commission since 2006. Over the past decades I've worked for U.S. Representatives Morris K. Udall and Karan

English (Arizona), and Arizona's State Supreme Court, Court of Appeals and State Senate, as well as private management and technology consulting firms. I have a Juris Doctorate degree from Arizona State University.

Q. WHAT ISSUES WILL YOUR TESTIMONY ADDRESS?

A. My testimony will address the issues requested by the Commission's February 25, 2014 Order Establishing Biennial Proceeding and Scheduling Hearing (the "Order"), and other issues as requested by the Order.

Q. CAN YOU BRIEFLY SUMMARIZE THE GROWTH OF U.S. SOLAR?

A. The Order states the "Commission recognizes the potential magnitude of DG [distributed generation] and utility [scale] solar." The total installed solar capacity in the U.S. is currently approximately 12 gigawatts (GW). Approximately 500 MW of solar has been installed on nearly 450,000 rooftops, while the majority of capacity is utility-scale solar, primarily ground-mounted. There is nearly 1 GW of Concentrating Solar Power ("CSP" or utility-scale solar thermal) now online in the U.S.

In the past 18 months, the U.S. installed more solar than in the past 30 years combined. During 2012, solar installations increased over 40%. There are currently over 140,000 solar jobs in the U.S., and weighted average photovoltaic ("PV") system prices fell 15% in 2013, reaching a new low of $2.59/W in the fourth quarter. The Solar Energy Industries

Association ("SEIA"), a national trade association, estimates an increase of 26% in PV installations in 2014, and says growth will occur in all segments, but most rapidly in the residential market.

Utility concerns that solar PV will negatively impact earnings and profits have grown along with the increase in solar installations. There is an intense debate around the country, as well as in North Carolina, over the costs and benefits of solar, both distributed and utility-scale. At least 15 states currently have dockets addressing the costs and benefits of solar. The Edison Electric Institute, a utility trade group, along with national labs, solar advocates and research institutes such as the Rocky Mountain Institute ("RMI") are asking the same question: what is the value of a solar kWh?

North Carolina has over 210 sunny days per year, and installed 335 MW of solar in 2013 alone. North Carolina moved from fifth in total U.S. solar installations to third, for a total installed capacity of 557 MW of solar power. Unlike most other leading solar states, North Carolina has a very small number of solar rooftops at 1,300. In 2013, $787 million was invested in North Carolina for solar (an increase of 156% from the previous year) and the average installed cost dropped 29% in 2013.[1] North Carolina clearly has much to gain from a growing solar industry. Every $1 North Carolina invests in tax credits for renewable energy results in $1.93 in payments to state and local governments. Between 2007 and

[1] See www.seia.org/state-solar-policy/north-carolina for information on North Carolina's solar industry.

2013, approximately $2.7 billion was invested in renewable energy and energy efficiency, supporting 36,885 annual full-time equivalents (FTEs). Since 2007, clean energy development has generated $236.3 million in state and local tax revenue. Renewable energy project development in 2013 was $732.4 million, or nearly 42 times the $17.5 million investment in 2007. From 2007-2013, the total economic benefit of clean energy development in North Carolina was over $4.7 billion.[2]

Q. CAN YOU ADDRESS CONCERNS ABOUT THE GROWTH OF SOLAR AND HOW IT SHOULD BE VALUED?

A. The 2014 Order describes solar as "potentially disruptive, both positive[ly] and negative[ly]," a "changing landscape" that "merit[s] further consideration."

The Commission is correctly addressing these critical issues up-front, as the solar landscape is changing quickly. NC WARN is asking the Commission to note that integration costs occur with *all* types of generation,[3] and recognize that the near-zero water use of solar, zero risk of fuel cost increases, zero toxic emissions, zero waste storage costs, and 25-30 year panel life provide tangible, measurable value to North Carolina's ratepayers. A transparent process is key, since what benefits

[2] RTI International for the NC Sustainable Energy Association, *Economic Impact Analysis of Clean Energy Development in North Carolina – 2014 Update,* April 2014; http://energync.org/assets/files/NCSEA_2013_update_final.pdf

[3] www.nrel.gov/docs/fy11osti/47078.pdf

Duke Energy's executives and shareholders do not necessarily benefit North Carolina's ratepayers and citizens.

Attachment A is a chart from RMI's May 2013 *Review of Solar PV Benefit & Cost Studies.*[4] RMI's "study of studies" looks at fifteen different reports on how to accurately value distributed solar. The studies were produced from a wide variety of viewpoints, including electric utilities, utility trade groups, solar advocates and national labs, and the oldest of the studies is only eight years old. RMI's goal was to determine what is "known and unknown" about the methods, categories and gaps in each of the 15 studies. Attachment A is the "bulls-eye" chart from the RMI study that addresses seven categories: (1) energy, (2) capacity, (3) grid support services, (4) financial risk, (5) security risk, (6) environmental costs and benefits and (7) social costs and benefits. RMI's report did not reach a conclusion, but rather looked at how the reports differed on issues such as granularity of data and which values were included or excluded. The values for distributed solar ranged widely from -14.57 cents/kWh to 33.93 cents/kWh. RMI noted that major gaps existed between the studies, particularly in the valuation of distribution capacity, grid support services, and a handful of non-monetized categories such as security, environmental impact, and social impact.

To assist the Commission in its consideration, I will address a number of other relevant issues about the value of solar.

[4] Rocky Mountain Institute, *A Review of Solar PV Benefit & Cost Studies,* June 2013; www.rmi.org/elab_empower

a. Solar beat natural gas on economics in a Minnesota Commission decision in March 2014. The Minnesota Commission determined in March 2014 that a solar plant has a lower long-term cost than a natural gas plant,[5] and directed Xcel Energy to purchase $250 million worth of distributed solar (with some natural gas back-up) rather than invest solely in natural gas.[6] The Commission determined that solar PV's modularity added value, especially when future demand for power is uncertain. Natural gas peakers run so infrequently (4-8% of the hours in a year) that the cost per kWh is relatively high. Solar is predictably available on hot summer days when power is most needed (100 MW of solar was given a capacity credit of 71 MW). In addition, the 30% federal Investment Tax Credit reduced the cost of solar, the social cost of carbon[7] will dramatically increase the gas plant's lifetime cost, and solar reduces transmission costs.[8] Although Minnesota's solar market price includes

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5 http://fresh-energy.org/2014/01/how-solar-beat-gas-in-minnesota/

6 www.startribune.com/business/252724541.html and www.eenews.net/stories/1059996889

7 The social cost of carbon is estimated by the EPA at between $11-$52/ton and a central value of $33/ton, but other estimates show the social cost of carbon at $55-$266/ton. See www.greentechmedia.com/articles/read/on-cost-new-clean-energy-is-beating-coal. Even with a cost of carbon at $11-$52/ton, renewable energy often is cheaper because new coal costs 13.2 cents/kWh, with new wind at 8 cents/kWh. At the $52/ton for CO2, coal jumps to 14.7 cents/kWh, and that makes even solar PV, at 13.3 cents per kilowatt-hour, a better bargain.

8 MN Public Utilities Commission Docket No. E-002/CN-12-1240, *Findings of Fact, Conclusions of Law and Recommendation*, 12/31/13; www.edockets.state.mn.us/EFiling/edockets/searchDocuments.do?method=showPoup&documentId=%7BBDCD83F5-1BBA-46C8-972C-D07191477C0B%7D&documentTitle=201312-95007-01

eight separate factors, the largest four account for most of the value: (1) 25 years of avoided natural gas purchases, (2) avoided new power plants, (3) avoided transmission capacity, and (4) avoided environmental costs. Minnesota's solar advocates submitted data showing that over a solar system's lifetime, customers will save about $3,000.[9] In sum, the Minnesota Commission determined solar beat natural gas on life-cycle costs.

b. Solar plus storage is a potential game changer. There are many good studies for the Commission to consider in determining how to best value solar, and evolving issues such as storage, voltage support and how distributed generation adds stability to the grid are just starting to be seriously addressed by Commissions around the country. Not surprisingly, the states that were hit hard by Hurricane Sandy are looking at the security value of solar with storage during extreme weather events.

Although solar variability is obvious – the sun does not shine at night – there are solutions already in place, such as the 280 MW Solana concentrating solar power plant in Arizona, with a 38% capacity factor. Molten salt storage provides electricity for 6 hours after the sun goes down, and is particularly valuable during Arizona's late afternoon peak

[9] *Could Minnesota's "Value of Solar" Make Everyone a Winner?* By John Farrell, March 17, 2014; www.renewableenergyworld.com/rea/blog/post/2014/03/could-minnesotas-value-of-solar-make-everyone-a-winner and www.greentechmedia.com/articles/read/in-bid-against-gas-minnesota-regulators-say-solar-can-proceed The company building the solar plant has pledged to make payments in lieu of taxes to local governments, ranging from $50,000 to $110,000 a year.

demand time.[10] Even in the diffuse light of North Carolina and Florida, Professor Goswami at the University of Florida has developed a similar salt-based energy storage system that can be used at the residential and business scale. California is requiring utilities to install 1.3 GW of storage by 2020.[11] Although 500 solar customers in California have requested interconnection to utilities for solar systems with storage, utilities have slow-walked these requests and SolarCity, the national provider of solar systems, has stopped taking orders until the utilities process the backlog.[12]

The latest report by RMI is on the "economics of grid defection," and looks at four locations in the U.S. to determine when solar plus batteries will reach grid parity. Since solar-plus-batteries will reach grid parity within the 30-year planned economic life of transmission and central station power plants, these issues are well worth considering now.[13]

c. Solar PV uses very little water. According to a report on the energy-water nexus, *Burning Our Rivers*, the total consumptive water use of PV is 2 gallons/MWh, versus coal's total water withdrawal of 16,000

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[10] See www.lasvegassun.com/news/2009/dec/31/racing-sun/ and http://blogs.phoenixnewtimes.com/valleyfever/2013/10/solana_10_facts_you_didnt_know.php?page=4

[11] See CA PUC Rulemaking 10-12-007, filed 6/10/2013; http://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M065/K706/65706057.PDF

[12] www.renewableenergyworld.com/rea/news/article/2014/03/solarcity-freezes-energy-storage-program-as-utilities-resist-grid-connections

[13] Rocky Mountain Institute, *The Economics of Grid Defection*, March 2014; www.rmi.org/electricity_grid_defection , for more information jcreyts@rmi.org

gallons/MWh, including 692 gallons/MWh consumption. Although solar thermal power plants use as much water as coal to generate electricity, coal uses ten times more water than concentrating solar plants during its lifecycle. Coal's *lifecycle* water footprint is enormous, far more even than nuclear power.[14]

d. Solar capacity is based in part on locational value. The previously mentioned RMI report on the costs and benefits of solar[15] discusses the "locational value" of solar. It points out that the Long Island Power Authority in New York provides 7 cents for each solar kWh in long-term power purchase agreements for solar located in areas of highest demand. RMI's paper also discusses the overlap between capacity value and energy losses, as higher loads on distribution feeders means higher relative line losses, which should be reflected in the capacity value of solar.

Solar also adds value in lessening transmission-line "congestion" and surely deserves payment just as utilities charge more for transmission line use in high-demand locations. For example, the Commission commissioned a 2013 study for Dominion NC and determined that while

[14] River Network, *Burning Our Rivers,* www.rivernetwork.org/sites/default/files/BurningOurRivers_0.pdf Chart 1 on page 10 shows the lifecycle Water Use of Electricity for most resources.

[15] www.rmi.org/elab_empower

the costs varied widely, in the years 2011-2012 transmission congestion cost Dominion nearly $7 million.[16]

A 2011 study on the value of solar by experts Zweibel, Perez and Hoff found tangible benefits from solar include environmental, fuel price mitigation, outage risk protection and long-term economic growth potential. The report concluded that PV delivers 15-40 cents/kWh in benefits to ratepayers and taxpayers.[17]

e. Geographically dispersed solar adds grid stability, and reduces reserve margins. A study by the National Renewable Energy Lab ("NREL") demonstrated that with a larger balancing authority[18] and sub-hourly dispatch, variable energy sources like solar and wind can save money. When variable generation resources are spread out over a larger geographic area, costs are reduced because utilities share reserves.[19] PJM, the Regional Transmission Operator in the Northeastern U.S., oversees 350 GW per month of auctioned power in many Mid-Atlantic States, including Virginia.[20] PJM's transparency has allowed demand

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[16] Monitoring Analytics, *Report to the NCUC, Congestion in the Dominion Service Territory in NC: May 1, 2011 through April 30, 2013,* July 15, 2013, see page 2. http://www.monitoringanalytics.com/reports/Reports/SR2013/State_Congestion_Report_NC_DOM_20130715.pdf

[17] Richard Perez, Ken Zweibel and Thomas Hof , *Solar Power Generation In The U.S.: Too Expensive, or a Bargain*?; www.asrc.cestm.albany.edu/perez/2011/solval.pdf

[18] A balancing authority is the responsible entity that integrates resource plans ahead of time, maintains load-interchange-generation balance within a Balancing Authority Area, and supports Interconnection frequency in real time.

[19] www.nrel.gov/docs/fy12osti/56236.pdf and www.nrel.gov/docs/fy13osti/57115.pdf

[20] *Total volume, dollars down in PJM's monthly FTR auction*, Washington (Platts)--31Mar2014/550 pm EDT/2150 GMT; www.platts.com/latest-news/electric-

response, also known as demand-side management ("DSM"), programs to compete on a more level playing field, with the PJM territory having more DSM than nearly any other part of the country.[21] PJM studies have also shown solar PV is an effective means not only to reduce peak, but also to provide a more stable system. For example, 500 MW of PV would have averted the August 2003 grid failure in PJM and Canada that left 50 million people without electricity. In fact, while purchasing that amount of PV would have cost $3 billion, the one-time outage itself cost $8 billion.[22]

Of crucial import to the present docket, PJM recently commissioned a study by General Electric (GE)[23] showing that PJM could increase solar and wind to 30% without any "significant" issues. In other words, the PJM territory could install 110,000 MW of solar and wind, enough to power 23.5 million homes, with no additional back-up spinning reserves needed.[24]

f. Solar is reducing wholesale power costs. Ohio regulators determined that clean energy reduced the cost of wholesale power by

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power/washington/total-volume-dollars-down-in-pjms-monthly-ftr-21407462

[21] http://thinkprogress.org/climate/2011/07/25/278369/this-looks-like-a-job-for-solar-pv-heat-wave-causes-record-breaking-electricity-demand/

[22] Presentation by Tom Hoff and Richard Perez, page 10; www.istandfor.com/images/FE/chain250siteType8/site210/client/Perez_Value_of_Solar_in_NY.pdf

[23] www.pjm.com/forms/registration/Meeting%20Registration.aspx?ID=%7b3771E268-C77B-43E3-B655-6BC8EAFB78A7%7d and 4-page summary released February 28, 2014; www.pjm.com/~/media/committees-groups/committees/mic/20140303/20140303-pris-executive-summary.ashx

[24] www.greentechmedia.com/articles/read/nations-largest-grid-operator-huge-renewables-expansion-wont-be-a-problem

0.15%, and Illinois regulators found that clean energy reduced fuel costs.[25] Solar is now as cheap as conventional electricity in Germany and Italy.[26] In fact, Germany's second largest utility, RWE, stated late in 2013 that it would position itself as an integrator of renewables. Due to high levels of clean energy like solar coming online during peak summer hours, the cost of wholesale power has been *reduced*. RWE provides gas and electricity for 24 million customers throughout Europe, and its share price lost one-third of its value over the past three years due to erosion of revenues from its thermal generators.[27]

g. Banks are investing heavily in clean energy. Goldman Sachs recently announced a $40 billion investment in solar financing.[28] Citibank's most recent report on renewable energy says that solar and wind will continue to decrease in price, and will become increasingly competitive with natural gas. The report notes that the ability of solar to provide electricity at peak power times makes it competitive with natural gas on

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[25] www.midwestenergynews.com/2013/09/05/report-ohio-renewable-energy-law-cuts-costs-emissions/

[26] http://thinkprogress.org/climate/2014/03/24/3418145/solar-grid-parity-italy-germany/ In fact, Germany's wholesale prices for electricity have decreased from 5.115 cents/kWh in 2012 to 3.9 cents: http://cleantechnica.com/2013/09/03/renewable-reducing-electricity-prices-in-germany/

[27] Stephen Lacey, *Under Threat, Germany's Second-Biggest Utility Says It Will Create a New 'Prosumer' Business Model,* October 23, 2013; www.greentechmedia.com/articles/read/germanys-largest-utility-shifts-strategy-saying-solar-will-threaten-the-com

[28] https://joinmosaic.com/blog/goldman-sachs-investing-renewable-energy/?utm_source=Mosaic+Newsletter&utm_campaign=bb79c46cd5-Mar_Newsletter_3_18_2014&utm_medium=email&utm_term=0_0e152f2d87-bb79c46cd5-317852093

life-cycle costs. Citibank expects the cost of PV modules to decline 11% per year, and balance of systems costs, i.e., all components of a photovoltaic system other than the photovoltaic panels, to decline 8% per year.[29]

Q. PLEASE COMMENT ON THE RELEVANCE OF THIS DOCKET TO OTHER DOCKETS BEFORE THE COMMISSION.

A. The Order asks for comments on this docket's "relevance to the Renewable Energy and Energy Efficiency Portfolio Standard (REPS), Integrated Resource Plan (IRP) and future avoided cost determinations." All these issues converge to a question the Commission must answer: what is the value of a solar kWh, and how does solar compare with other resources? In other words, what are the costs, benefits and risks of going forward for each type of generation resource (or energy efficiency/demand response measure)? What are the estimated future costs for utility-scale and distributed solar, coal, nuclear and natural gas power plants, and what would be the outcome of North Carolina's long-term commitment to natural gas, coal, solar, wind, combined heat and power and other demand and supply side resources? How the Commission chooses to value a solar kWh can either help North Carolina create a vibrant clean energy economy, or set the state back years.

Cost-benefit issues germane to the IRP, REPS and future avoided cost determinations are:

[29] Shar Pourreza, *The Age of Renewables is Beginning, A Levelized Cost of Energy (LCOE) Perspective*: http://www.businessinsider.com/citi-the-age-of-renewables-is-beginning--2014-3

- Costs of importing 100% of fossil fuels for electricity versus clean energy's zero fuel costs; and
- Costs to comply with environmental regulations on coal plants, including mercury, ash, air and water pollution, potential carbon costs, and current acid rain and ozone regulations.[30]

Coal-burning power plants comprise the largest source of toxic pollution in our state, our country and our world. Coal-burning power plants emit 66% of all acid-rain-causing sulfur dioxide, approximately 40% of mercury, which poisons our waterways and aquatic life, and 40% of the total carbon dioxide emissions in the U.S. The U.S. burns about 1 billion tons of coal every year, and each ton of coal leaves behind about 13% by volume in coal ash. The average coal plant in the U.S. is almost 40 years old, and every year coal ash has been piling up. Only an estimated 25% of coal ash ponds in the U.S. have groundwater monitoring. Estimates for the cleanup and remediation of the coal ash impoundments in North Carolina are now in the $10 billion range.[31]

I believe the concept of "life-cycle" cost is critical and should be applied in the avoided cost docket. A key part of this is to review discount rates. Current regulatory rules provide fossil plants an unfair advantage by

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[30] Jim Lazar and Ken Colburn, *Recognizing the Full Value of Energy Efficiency: What's Under the Feel-Good Frosting of the World's Most Expensive Layer Cake,* September 2013, page 37, Figure 5; www.raponline.org/event/recognizing-the-full-value-of-efficiency-theres-more-layers-in-the-layer-cake-than-many-account Cost to comply with all coal regulations could be 10 cents/kWh.

[31] Statement by Mr. Paul Newton, President Duke Energy North Carolina, to Legislative Environmental Review Commission, April 23, 2014.

discounting the enormous *risk* of rapid increases in the cost of fuels. I believe that we must start to address not just today's commodity cost of fossil fuel, but the very real risk of guessing what fuel will cost in 10, 20 or 30 years. I agree with RMI that discount rates for environmental and social values should use Treasury bond rates, while elements that are part of the utility's balance sheet (grid services, financial and security), should use the utility's averaged weighted cost of capital.[32]

An excellent report looking at distributed generation costs applicable to the IRP, REPS and future avoided cost proceedings is from Princeton's energy roundtable in April 2013. The roundtable's objectives were to establish a dialogue among various stakeholders, agree on a new valuation approach, delineate cost/benefit categories, and set the stage for an inclusive process to clarify and measure each category.[33] The report's authors, including utility Commissioners, distributed energy providers, industry experts and academics, analyzed the challenges of valuing distributed energy and found that as distributed generation increases both risks *and* benefits must be managed.

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[32] www.rmi.org/Content/Files/eLab-DER_cost_value_Deck_130722.pdf

[33] Travis Bradford and Anne Hoskins, *Valuing Distributed Energy: Economic and Regulatory Challenges, Working Paper for the Princeton Roundtable April 26, 2013,* Background: http://acee.princeton.edu/wp-content/uploads/Distributed-Energy-Valuation-Paper.pdf The Princeton study considered various Distributed Energy (DE) capacity values for solar, wind, demand response, energy efficiency, storage and combined heat and power. The study considered various ways of determining avoided cost and asked whether these current methods accurately reflect current DE capacity values; and at Net Metering, Austin Energy's Value of Solar Tariff (VOST), California's Market Price Referent (MPR) and Locational Marginal Pricing (LMP).

The Commission might find the roundtable approach useful. I recommend that the Commission open a separate docket to determine the value of solar for North Carolina in which the Public Staff, all stakeholders and the Commission can benefit from ongoing "value of solar" dockets currently in play around the U.S.

North Carolina's Renewable Energy and Energy Efficiency Portfolio Standard ("REPS") recognizes the value of clean energy and a healthy environment. However, as the battles around the U.S. clearly demonstrate, Public Utilities Commissions can develop policies that assist in the development and use of clean energy or develop policies that set up barriers. As current Florida gubernatorial candidate Charlie Crist recently noted, the Sunshine State does not have much solar. The reason is that Florida, like North Carolina, has disallowed solar leasing. In fact, less-sunny states Pennsylvania and Massachusetts are powering ahead of Florida on solar.

Q. CAN YOU COMMENT ON THE APPROPRIATENESS OF THE USE OF PERFORMANCE ADJUSTMENT FACTOR IN AVOIDED COST RATES?

A. The Order states that it "may no longer be appropriate" to use the previous PAF (Performance Adjustment Factor) framework to determine avoided capacity cost rates." PAF values for power plants include factors such as emissions, heat rate, capacity factor plant lifetime, peak availability, risk, and operation and maintenance. In short, PAF helps to

define cost or value. I believe the current PAF for solar of 1.2 is far too low, and should be revised upward to at least 2.0 because of the high value of solar during peak summer hours, the fact that solar displaces purchased and hedged fuel for 25 years, reduces water use, reduces pollution and reduces waste treatment and storage. These factors add real value for North Carolina's ratepayers.

I believe, as does NC WARN, that solar deserves its own unique value, or tariff, that is separate from hydro sources and wind. In the Commission's previous decision on avoided cost, dated February 21, 2014, in Docket E-100, Sub 136, the Commission put solar and wind in the same "category."[34] We believe this is not accurate as solar is much more predictable than wind and should be awarded a higher value than wind. More important, in comparison to wind, solar PV is available and cost-effective now, and easily added to the grid. Other states have already awarded a greater capacity value for solar over wind. In mid-2013, Texas regulators awarded solar a 100% capacity value (up to 200 MW), and after that, a 70-80% capacity value; with wind's capacity value set at 14-33%, depending on whether it was coastal or non-coastal.[35]

[34] See page 7 of the Order dated February 21, 2014 in Docket E-100, Sub 136.

[35] www.greentechmedia.com/articles/read/solar-and-wind-get-higher-capacity-values-from-ercot and ERCOT, *Report on Capacity, Demand and Reserves in the ERCOT Region*, May 2013; www.ercot.com/content/news/presentations/2013/CapacityDemandandReserveReport-May2013.pdf

The National Renewable Energy Lab completed an Eastern Wind Study, which might be of value to the Commission. The purpose is to:

> evaluate the ability of greater inter-regional cooperation, geographic diversity, and sub-hourly scheduling to provide operational flexibility; identify the need for mitigation strategies at high levels of penetration; develop and test reserve strategies to accommodate ramping requirements; explore the impact of key assumptions on analytical results; and provide more detailed analysis of results.[36]

The potential for wind in North Carolina, especially in coastal areas and off-coast, is substantial although does not have the immediate impact of solar.

Q. CAN YOU COMMENT ON OTHER ISSUES REGARDING THE PAF?

A. The Order states that the "Commission will revisit precedents," including whether the 2.0 PAF for run-of-river hydroelectric with no storage should be continued. Clearly, run-of-river hydro, wind and solar have very different characteristics and should be reviewed separately. However, taken together they have synergistic benefits to the electric system which should also be reviewed.

Q. PLEASE COMMENT ON METHODS TO CAPTURE THE FULL AVOIDED COSTS.

A. The Order states the Commission would like comments on "whether the methodologies historically relied on to determine avoided cost capture the full avoided costs."

[36] www.nrel.gov/electricity/transmission/eastern_renewable.html

Coal ash spills like the TVA spill in 2008 and the current Dan River spill demonstrate starkly that we need to start including the very real costs and risks of externalities.[37] The U.S. EPA's determination that the societal value of coal regulations is *30 times greater* than the coal compliance costs. In other words, for every $1 spent on coal emissions control, society reaps $30 in benefits.[38]

The fact that this battle is raging in North Carolina as well as in at least twenty other states shows that our current methods to determine value for clean energy are not working. A number of states have given greater value to clean kWhs, and are reaping benefits including reduced fuel imports, cleaner air and water, and reduced health and environmental costs. There are a number of excellent studies considering new approaches to determine avoided cost, including Carolyn Elefant's *Reviving PURPA's Purpose: The Limits of State Avoided Cost Ratemaking Methodologies in Supporting Alternative Energy Development and a Proposed Path for Reform,*[39] and excellent studies by the Interstate Renewable Energy Council (IREC) and NCSEA witness Karl Rabago.

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[37] U.S. Energy Information Administration, Glossary. Externalities are the "benefits or costs, generated as a byproduct of an economic activity, that do not accrue to the parties involved in the activity. Environmental externalities are benefits or costs that manifest themselves through changes in the physical or biological environment."

[38] EPA: *The Benefits and Costs of the Clean Air Act from 1990 to 2020, Second Prospective Study*; www.epa.gov/cleanairactbenefits/prospective2.html

[39] www.recycled-energy.com/images/uploads/Reviving-PURPA.pdf

The new valuation method must be transparent, involve all stakeholders, and consider costs and benefits such as carbon, pollution, waste and damage costs from fossil fuels, as well as a range for health and other benefits from clean energy such as reduced water use, reduced toxics and environmental compliance costs. Clearly, the environmental and health benefits from clean energy are worth more than the "zero value" currently assigned.

And although job and economic value are not usually considered, the fact that there are 140,000 solar jobs in the U.S. and approximately 70,000 wind jobs, but only 85,000 coal mining jobs, is significant. The American Wind Energy Association and the Union of Concerned Scientists estimate that if the U.S. Congress passed a 25% by 2025 Renewable Energy/Energy Efficiency standard, North Carolina would save nearly $1 billion by 2030 in fuel savings.[40] One dollar spent at a local store circulates 2-3 times more in the local economy than dollars spent out of state to purchase coal and natural gas.[41] North Carolina spends at least $2 billion/year, year after year, to purchase coal and natural gas from out of state. Keeping some of those dollars in-state makes sense. According

[40] Union of Concerned Scientists, *How Much Would Consumers Save?;* www.ucsusa.org/clean_energy/our-energy-choices/renewable-energy/how-wind-energy-works.html and www.ucusa.org/assets/documents/clean_energy/Clean-Power-Green-Jobs-25-RES.pdf

[41] www.ilsr.org/why-support-locally-owned-businesses/

to experts on energy jobs, solar delivers more jobs per MW of capacity than any other generation source.[42]

Q. PLEASE COMMENT ON THE "VALUE OF SOLAR PROFFERED BY NCSEA AND MR. RABAGO" AS WELL AS THE *CROSSBORDER* STUDY.

A. NC WARN supports the position of NCSEA, and believes that the Commission should determine its own value of solar tariff. As various studies have noted, solar grid parity in NC is rapidly approaching.[43] In addition, the *Crossborder* study's finding that commercial solar provides a different set of benefits than residential solar systems adds impetus for a solar-specific tariff.

Q. CAN YOU ADDRESS "OTHER ISSUES PARTIES MAY WISH TO HAVE CONSIDERED" AS REQUESTED IN THE FEBRUARY 2014 ORDER?

A. As noted above, the currently uncounted costs of coal are coming under greater scrutiny. In fact, it is entirely possible that Duke Energy's costs for coal compliance are far higher than the cost of solar and renewables under the REPS. Duke Energy President Paul Newton has repeatedly stated that renewable energy could cost ratepayers $100 million/year for 15 years, but neglects to mention that Duke currently

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[42] Daniel Kammen et al; *Putting Energy Efficiency and Renewable Energy to Work: how many jobs can the clean energy industry generate in the U.S.?*; Energy Policy 38.2 (2010): 919-931; http://rael.berkeley.edu/sites/default/files/WeiPatadiaKammen_CleanEnergyJobs_EPolicy2010.pdf

[43] www.greentechmedia.com/articles/read/grid-parity-for-solar-in-north-carolina-study/

spends at least $2 billion – twenty t0imes more than the cost of clean energy – ***every year*** to purchase coal and natural gas from out of state. At $93.74/ton, North Carolina ratepayers pay some of the highest rates in the U.S. for coal.[44] A recent interesting story reports that investors Michael Bloomberg, Richard Branson and Jeremy Grantham are considering to buy out the entire U.S. coal industry for $50 billion. According to various studies on the health and environmental benefits of reducing coal power, that $50 billion investment could yield over $500 billion/year in benefits to U.S. residents.[45]

I also would like to address Duke's assertion that solar costs low-income customers more than it costs middle class or wealthier ratepayers. It is clear that the health and environmental damages from coal are enormous, and coal plants tend to be located in poor, minority and rural communities.[46] The environmental justice issues are just as obvious. The fact that North Carolina does not allow solar leasing is also driving up the cost of residential solar, since solar system financing is difficult.

I also believe that utility discount rates are too high, thus favoring fossil fuel power plants over clean energy. When *future* fuel costs (10-20-30 years from 2014) are highly discounted (7-8-9%), the estimated cost of

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[44] Union of Concerned Scientists, *Burning Coal, Burning Cash, 2014 Update, North Carolina;* www.ucsusa.org/assets/documents/clean_energy/North-Carolina-Coal-Imports-BCBC-Update-2014.pdf

[45] www.theguardian.com/sustainable-business/us-coal-industry-buyout

[46] http://earthjustice.org/news/press/2011/communities-of-color-poverty-bear-burden-of-air-pollution

purchasing fuel in 10 or 20 years could be off by orders of magnitude. **Attachment B** is a graph of *Actual v. Projected U.S. Average Wellhead Natural Gas Prices* illustrating how difficult it is to determine natural gas costs. Between 2007 and 2008, the cost of natural gas doubled; and price spikes have followed breaks in supply caused by hurricanes such as Katrina in August 2005.

The effect of *over-estimating* future natural gas *production* can also artificially lower Levelized Cost of Energy, or LCOE.[47] Purchased fuel accounts for 60-80% of the *lifetime cost* to run a fossil fuel power plant, while the life-time costs for solar are simpler and up-front, with zero fuel costs, zero fuel hedging costs, zero coal ash waste disposal costs, zero nuclear waste disposal costs and practically zero water costs. Solar plants go up quickly, rarely have cost overruns, and are built on-time. We need regulatory rules that value these and the many other benefits clean energy brings to our communities, and rate structures that recognize the broad benefits of clean electricity over dirty. Utilities complain about cost-shifting, but the largest cost-shift has been from utilities to citizen-ratepayers as we all absorb the enormous health and environmental damages from fossil fuels. Utilities have profited handsomely while ignoring the enormous and ever-growing costs of damages from fossil fuels.

Q. CAN YOU PLEASE PROVIDE A LIST OF YOUR RECOMMENDATIONS FOR THE COMMISSION?

[47] LCOE is supposed to reflect the all-in, lifetime costs of generation. http://en.wikipedia.org/wiki/Cost_of_electricity_by_source

A. Yes. I recommend that the Commission commence an open, transparent process, including all stakeholders, and:

- discuss the values to include in a solar tariff *specific* to North Carolina's solar resources, existing generation fleet, load profile and other relevant considerations;
- review the many studies already been done to determine what cost and benefit categories should be included in the valuation of solar, and follow the suggestions from the RMI study and others that solar's avoided capacity, social and environmental benefits need to be included;
- monetize solar's value in decreasing emissions, decreasing coal compliance costs, decreasing other wastes such as coal ash, decreasing water use and pollution, decreasing air pollution, decreasing carbon emissions and decreasing imported fuel costs;
- consider the value that clean energy jobs and development provide for North Carolina's citizens;
- recognize the value clean energy brings from increased tax payments and other benefits to state and local government;
- include the capacity and locational value of solar as a resource that provides power close to load during expensive summer peaking hours; and
- acknowledge the enormous value solar brings in permanently displacing imported, expensive and volatile coal and natural gas

fuel, and the huge water requirements of fossil fueled thermal generation.

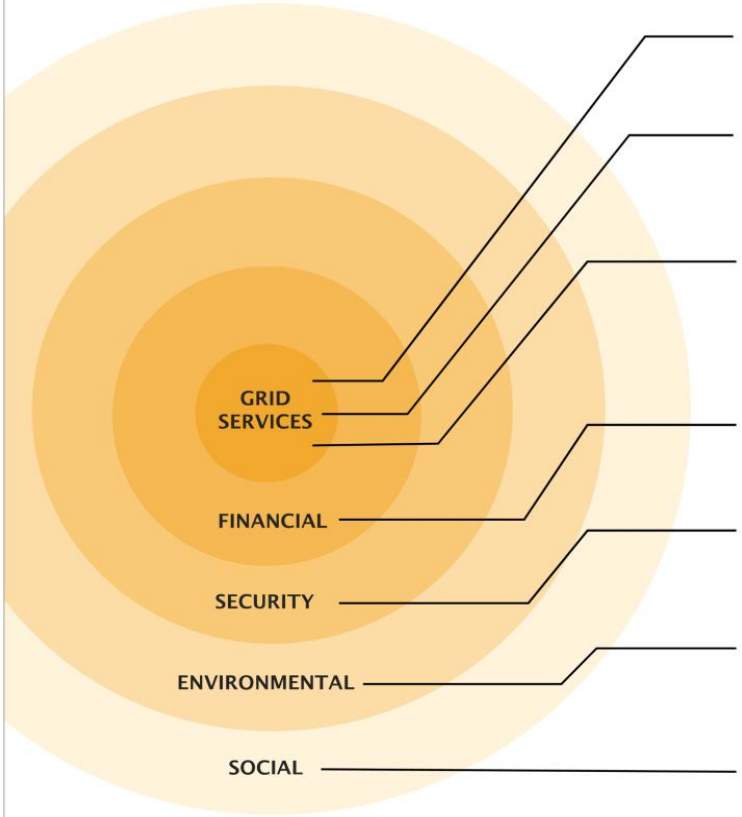
Q. DOES THAT CONCLUDE YOUR TESTIMONY?

A. Yes.

BENEFIT & COST CATEGORIES

e Lab
Electricity Innovation Lab
ROCKY MOUNTAIN INSTITUTE

For the purposes of this report, **value is defined as net value, i.e. benefits minus costs.** Depending upon the size of the benefit and the size of the cost, value can be positive or negative. A variety of categories of benefits or costs of DPV have been considered or acknowledged in evaluating the value of DPV. Broadly, these categories are:



ENERGY
- energy
- system losses

CAPACITY
- generation capacity
- transmission & distribution capacity
- DPV installed capacity

GRID SUPPORT SERVICES
- reactive supply & voltage control
- regulation & frequency response
- energy & generator imbalance
- synchronized & supplemental operating reserves
- scheduling, forecasting, and system control & dispatch

FINANCIAL RISK
- fuel price hedge
- market price response

SECURITY RISK
- reliability & resilience

ENVIRONMENTAL
- carbon emissions (CO_2)
- criteria air pollutants (SO_2, NO_x, PM)
- water
- land

SOCIAL
- economic development (jobs and tax revenues)

Attachment B

From Figure 1: EIA Estimates of natural gas prices v actual, Annual Energy Outlook 2013.