STATE OF NORTH CAROLINA
UTILITIES COMMISSION
RALEIGH

DOCKET NO. EMP- 92, SUB 0

BEFORE THE NORTH CAROLINA UTILITIES COMMISSION

In the Matter of	)	
Application of NTE Carolinas II, LLC for a	)	TESTIMONY OF
Certificate of Public Convenience and Necessity	)	WILLIAM E. POWERS
to Construct a Natural Gas-Fueled Electric	)	ON BEHALF OF NC
Generation Facility in Rockingham County,	)	WARN
North Carolina	)	

Q. WHAT IS YOUR NAME AND BUSINESS ADDRESS?

A. My name is William E. Powers, P.E., and I am principal of Powers Engineering, 4452 Park Blvd., Suite 209, San Diego, CA 92116.

Q. WHAT IS YOUR OCCUPATION AND EXPERIENCE?

A. I am a consulting and environmental engineer with over 30 years of experience in the fields of power plant operations and environmental engineering. I have worked on the permitting of numerous combined cycle, peaking gas turbine, micro-turbine, and engine cogeneration plants, and am involved in siting of distributed solar photovoltaic (PV) projects. I began my career converting Navy and Marine Corps shore installation projects from oil firing to domestic waste, including wood waste, municipal solid waste, and coal, in response to concerns over the availability of imported oil following the Arab oil embargo in the 1970's.

I authored "*San Diego Smart Energy 2020*" (2007) and "(*San Francisco) Bay Area Smart Energy 2020*" (2012), and have written articles on the strategic cost and reliability advantages of local solar over large-scale, remote, transmission-dependent renewable resources.

Q. WHAT IS YOUR EDUCATIONAL BACKGROUND?

A. I have a B.S. in mechanical engineering from Duke University, an M.P.H. in environmental sciences from UNC – Chapel Hill, and am a registered professional engineer in California.

Q. FOR WHOM ARE YOU SUBMITTING YOUR TESTIMONY?

A. I am submitting this testimony on behalf of NC WARN in response to the July 29, 2016, Application for a Certificate of Public Convenience and Necessity for a Merchant Plant submitted by NTE Carolinas II, LLC ("NTE") and testimony of NTE witness, NTE Vice President Mr. Michael C. Green.

Q. DO YOU HAVE AN OPIONION OF THE NEED FOR THE PROPOSED POWER PLANT?

A. Yes. As part of my review of whether the proposed power plant meets the requirements of N.C. G.S. 62-110.1 for a certificate of public convenience and necessity (CPCN), I reviewed the need for the project. The primary purpose of the CPCN statute is to prevent costly overbuilding of unneeded power plants.

There is no evidence of actual growth in peak demand or annual electricity usage in Duke Energy Carolinas (DEC) service territory, Duke Energy Progress (DEP) service territory, or North Carolina or South Carolina in the last decade. Mr. Green references the 2015 DEC and DEP Integrated Resource Plans ("IRPs") as the basis for projected DEC peak summer and winter demand growth rates from 2016 through 2030 of 1.5 percent.[1] Mr. Green references the DEP 2015 IRP as the basis for projected DEP peak summer and winter demand growth rates from 2016 through 2030 of 1.5 percent and 1.3 percent, respectively.[2]

The IRP peak demand forecasts relied upon by Mr. Green are in conflict with the actual DEC and DEP peak demand trends over the last decade, as shown in Table 1.

Table 1. DEC and DEP actual summer and winter peaks, 2006-2014[3]

Year	DEC Peak, MW		DEP Peak, MW	
	Summer	Winter	Summer	Winter
2006	17,906	16,196	12,493	12,138
2007	18,988	16,460	12,656	11,991
2008	18,228	16,968	12,290	11,832
2009	17,397	17,282	11,796	12,531
2010	17,358	17,570	12,074	12,230
2011	17,651	16,002	12,094	11,338
2012	17,610	15,307	12,770	12,376
2013	18,239	18,859	12,248	14,159
2014	18,993	unverified[4]	12,219	unverified

[1] Green direct testimony, p. 7.
[2] Ibid, p. 8.
[3] 2011NCUC Annual Report Regarding Long Range Needs for Expansion of Electric Generation Facilities for Service in North Carolina, Table 3, p. 12; 2015 NCUC Annual Report Regarding Long Range Needs for Expansion of Electric Generation Facilities for Service in North Carolina, Table 3, p. 11.
[4] Ibid, p. 11. Winter peak demand for DEC and DEP identified as occurring after the summer 2014 peak (meaning the winter of 2014) are higher than the winter 2013 peak values (which occurred in January 2014). However, no information of any kind is provided in the section of the report that addresses details of the peak load events. In contrast, extensive detail is

Summer peak load forecasts have historically driven DEC and DEP resource planning.[5] There was no increase in DEC summer peak load between 2007 and 2014. The DEP summer peak load in 2014 was about 3 percent less than the DEP peak load in 2007. There is no basis for NTE Carolinas to assume any summer peak load increase in the 2016-2030 timeframe based on the trend of no actual increase in DEC and DEP peak loads over the last decade.

DEC and DEP winter peak loads were flat or declining in the 2006-2012 period. However, DEC and DEP reported anomalously high actual increases in winter peak loads in 2013 and 2014, reaching levels greater than forecast in the 2012 IRPs prepared by each utility. Both the DEC and DEP 2016 IRPs imply these loads were due to anomalous weather events, specifically polar vortex events.[6,7] These anomalous winter peak loads were presumptively driven by reliance on electric space heating in DEC and DEP

provided for the DEC and DEP peak events that occurred in January 2014. See p. 19 and p. 20. For this reason, this testimony treats the DEC and DEP winter peak demand reported on p. 11 for the winter of 2014 as "unverified."

[5] DEC, 2016 IRP, September 1, 2016, p. 5. "Historically, DEC's resource plans have projected the need for new resources based primarily on the need to meet summer afternoon peak demand projections."

[6] Ibid, p. 5. "For the first time in the 2016 IRP, DEC is now developing resource plans that also include new resource additions driven by winter peak demand projections inclusive of winter reserve requirements. The completion of a comprehensive reliability study demonstrated the need to include winter peak planning in the IRP process. The study recognized the growing volatility associated with winter morning peak demand conditions such as those observed during recent polar vortex events."

[7] 2015 NCUC Annual Report, p. 20. "DEC's system peaked at 19,151 MW on January 30, 2014, at the hour ending 8:00 a.m. at a system-wide temperature of 12 degrees. The 12 degrees is significantly colder than the 18 degrees assumed in the winter peak load forecast. . . At this time, the Company did not activate any of its DSM programs. However, during its second highest peak, which occurred on January 7, 2014, the Company did activate its DSM programs, reducing load by 478 MW."

service territories beyond forecast levels.[8] There is no discussion in either the DEC or DEP 2016 IRPs on adding exceptional space heating demand reduction measures to exceptional polar vortex conditions.

There was no increase in DEC retail electricity consumption between 2007 and 2015,[9] or in DEP retail electricity consumption between 2006 and 2015.[10] There was little or no increase in electricity sales in North Carolina or South Carolina between 2005 and 2014, and a decline between 2010 and 2014.[11] The North Carolina and South Carolina electricity consumption trends from 2005 through 2014 are shown in Table 2.

Table 2. Electricity consumption (gigawatt-hours per year), North Carolina and South Carolina, 2005-2014

State	2005	2007	2010	2012	2014
North Carolina	128,335	131,881	136,415	128,084	133,132
South Carolina	81,254	81,948	82,479	77,781	81,619

The only area of electricity sales growth for DEC and DEP has been wholesale power sales. However, given there has been no overall increase in electricity consumption in North Carolina or South Carolina over the last

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8 Ibid, p. 19. "DEP's 2014 annual system peak of 14,159 MW occurred on January 7, 2014, at the hour ending 8:00 a.m., at a system-wide temperature of 11 degrees. The 11 degrees is significantly colder than the 18 degrees assumed in the winter peak load forecast. DEP's 2013 and 2012 peaks were 12,166 MW in August 2013 and 12,770 MW in July 2012."
9 2016 DEC IRP, Table C-2, p. 95.
10 2016 DEP IRP, Table C-2, p. 91.
11 EIA, Sales to Ultimate Customers (Megawatthours) by State by Sector by Provider, 1990-2014,

decade, the wholesale load growth experienced by DEC and DEP is either load shifting within the Carolinas, meaning there is a concomitant decrease in the output of other existing generators in the Carolinas, or DEC and DEP are selling into external wholesale markets unrelated to electricity demand in the Carolinas.

The 2016-2030 DEC and DEP forecast load growth projections relied on by Mr. Green in his pre-filed testimony and by NTE Carolinas II, LLC as the basis for the CPCN application are wrong. There is no load growth for proposed NTE Carolinas II power plant to meet.

Q. CAN THE POWER PRODUCED BY THE PROPOSED PLANT BE MET WITH EXISTING GENERATION?

A. Yes. The 500 MW capacity of the proposed NTE Carolinas II power plant can be met with existing available regional hydro or combined cycle capacity. There are available off-the-shelf hydropower and combined cycle gas turbine options in the region to supply capacity if additional capacity is needed. Four Smoky Mountain Hydro units near the North Carolina-Tennessee border have a capacity of 378 MW and produce 1.4 million MWh annually. These units are in the TVA system, which is connected to DEP West by a single 161 KV line from TVA to the substation at the Walters Hydro Plant in DEP West. The power produced by these units is not currently contracted for purchase.[12] TVA has existing power contracts with four North Carolina electric cooperatives.[13]

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[12] Ibid, p. 11.
[13] 2015 NCUC Annual Report, p. 7.

The underutilized merchant 523 MW Columbia Energy combined cycle plant outside of Columbia, South Carolina, built more than a decade ago when the capital cost of combined cycle power construction was lower than it is today, could serve some or all of any need that might arise.[14] Columbia Energy LLC was granted party status in NCUC Docket E-2 Sub 1089 on February 4, 2016.[15] According to Columbia Energy, the company is pursuing efforts to sell its capacity via a power purchase agreement with DEP or DEC.[16]

The 940 MW Tenaska, Virginia, merchant combined cycle power plant is located approximately 80 miles north of Rockingham County. This plant sells its output to power wholesaler Shell Energy North America.[17] The plant operated at a capacity factor of approximately 60 percent in 2015.[18] On average, the 940 MW Tenaska, Virginia, plant has 350 – 400 MW of unused capacity.[19]

North Carolina electric cooperatives already contract for portions of the output of selected power plants operated by third parties. For example, the North Carolina Electric Member Cooperative (NCEMC) owns 100 MW of the 750 MW capacity of the DEC-owned W.S. Lee combined cycle power

[14] Petition to Intervene of Columbia Energy LLC, February 2, 2016, NCUC Docket E-2 Sub 1089, p. 1.
[15] Order Granting Petition to Intervene, February 4, 2016, NCUC Docket E-2 Sub 1089.
[16] Petition to Intervene of Columbia Energy LLC, February 2, 2016, NCUC Docket E-2 Sub 1089, p. 2.
[17] On average, the 940 MW Tenaska, Virginia, plant has 300 – 400 MW of unused capacity.
[18] EIA Form 923, calendar year 2015, Page 4.
[19] (1 - 0.60) x 940 MW = 376 MW.

plant scheduled to begin operation in 2017.[20] This plant is located in Anderson County, South Carolina, distant from many of the North Carolina electric cooperatives that are members of the NCEMC.

On behalf of Powers Engineering, I present the available capacity of TVA hydro resources, Tenaska, Virginia combined cycle plant, and Columbia Energy combined cycle plant as examples of regional available capacity. I have not conducted an exhaustive investigation of the universe of available capacity in the Carolinas or neighboring states, or the relative cost of power from these available resources relative to a new combined cycle plant in Rockingham County, North Carolina. However, it is reasonably certain that the cost of power from existing available hydro and combined cycle units will be lower than the cost of power from a new combined cycle plant serving the same load.

However, it is important to underscore that here is no reason to build any baseload capacity to meet once-in-a-generation polar vortex conditions that cause higher than expected winter peak loads. DEC dispatched 478 MW of demand side management (DSM) resources to partially address a polar vortex-induced extreme cold day on January 30, 3014. North Carolina's winter reliability needs would be more efficiently addressed by adding another 478 MW of DSM capacity that emits no GHGs for exceptional, once-in-a-generation polar vortex events than authorizing construction of the NTE

[20] Duke Energy Corporation Fact Sheet, W.S. Lee Natural Gas Combined Cycle Facility Anderson County, S.C., February 2015.

Carolinas II baseload high GHG-emitting natural gas-fired combined cycle power plant.

Q. DO YOU HAVE ANY OTHER CONCERNS ABOUT THE PROPOSED POWER PLANT?

A. Yes. Natural gas-fired power generation has a substantially greater greenhouse gas (GHG) emission footprint than previously understood. The carbon dioxide (CO_2) component of the GHG footprint of a combined cycle plant operating at design efficiency would be approximately 820 pounds per megawatt-hour (lb/MWh).[21] In contrast, the 2015 CO_2 footprint of grid power provided by DEC was 669 lb/MWh, about 20 percent less than the CO2 footprint of the proposed combined cycle plant.

When methane leakage emissions associated with natural gas production and transport are included, the total GHG footprint of the combined cycle plant increases substantially. Prominent studies show that methane in the atmosphere is 100 times more effective at trapping heat than carbon dioxide over a 10-year period. Methane leaks in significant quantities during the drilling, storage, transportation and burning of natural gas – especially shale gas.[22] The total GHG footprint of DEC grid power increases at a much more modest rate when methane emissions are included, as natural gas combustion accounts for only 11 percent of DEC's 2015 power mix. A comparison of the total GHG emissions of the proposed combined cycle

[21] See Attachment A.

[22] Robert W. Howarth, Cornell University, "Methane emissions: the greenhouse gas footprint of natural gas," September 2016: http://www.eeb.cornell.edu/howarth/summaries_CH4_2016.php

plant and DEC grid power, assuming minimum, average, and maximum estimated methane emissions of 1.8 percent, 4.2 percent, and 12.0 percent respectively,[23] is provided in Table 2. See Attachment B for supporting calculations.

Table 2. Comparison of total GHG emissions, proposed NTE Carolinas II combined cycle plant and 2015 DEC grid power mix

Source	Total GHG emissions (lb/MWh)		
	1.8% methane leakage	4.2% methane leakage	12.0% methane leakage
NTE Carolinas II combined cycle	1,188	1,679	3,276
2015 DEC grid power mix	718	784	998

Under any methane leakage scenario, the total GHG footprint from the NTE Carolinas II combined cycle power plant will be substantially above the total GHG footprint of DEC grid power.

Q. ARE THERE OTHER METHODS OF MEETING PEAK DEMAND?

A. Yes. Any demonstrable need for new capacity to meet summer or winter peak demand should be met with battery storage

Battery storage has been identified in at least one other state utilities commission proceeding as the preferred resource, through the utilities' own least-cost best-fit economic benefit assessment, over combustion turbine capacity to meet peak demand need.[24] Battery storage technology responds

[23] 1.8% emissions rate per EPA 2013 estimates of US average as of 2009; 4.2% emissions rate per average discussed in 2014 study, "A bridge to nowhere: methane emissions and the greenhouse gas footprint of natural gas" by Robert W. Howarth, Cornell University; 12% emissions rate per likely emissions from shale gas production discussed in 2015 study, "Methane emissions and climatic warming risk from hydraulic fracturing and shale gas development: implications for policy" by Dr. Robert W. Howarth, Cornell University.

[24] Southern California Edison, Application A.14-11-012 , *Testimony of Southern California Edison Company on the Results of Its 2013 Local Capacity Requirements Request For*

more quickly than a gas turbine and can store and release intermittent renewable energy. For example, both DEC and DEP assume that only 5 percent of solar nameplate capacity will be available to meet winter peak demand in their respective service territories. However, if battery storage is constructed to meet peak demand, solar power generated during the day can be stored and released in the morning or evening to meet the winter peak demand. Battery storage has the necessary characteristics to maximize the value of renewable energy resources as North Carolina transitions to higher levels of renewable power.

Q. WHAT IS YOUR CONCLUSION?

A. There is no trend toward increasing summer peak demand in DEC or DEP service territories, or any trend toward increasing annual electricity usage in either North Carolina or South Carolina, that the NTE Carolinas II combined cycle plant would be needed to address. The one recent increase in winter peak demand in DEC and DEP services territories occurred during the January 2014 polar vortex. This weather condition was unusual and not indicative of a pattern of rising winter peak load. The construction of a baseload gas-fired combined cycle power plant would not be a coherent response to a once-in-a-generation weather event. The GHG emission

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Offers (LCR RFO) for the Western Los Angeles Basin, November 21, 2014, pp. 57-58. "All (least-cost best-fit model) draws contained significant amounts of in-front-of-meter energy storage (Draw 1 had over 400 MW and Draw 25 had over 900 MW). . . SCE (then) limited the amount of in-front-of-meter energy storage that could be selected to 100 MW . . . Initially, in conjunction with the (100 MW) in-front-of-meter energy storage constraint, the optimization selected a higher amount of gas-fired generation. This was largely due to the (100 MW) limitation on in-front-of-meter energy storage, and gas-fired generation being the next economic resource in terms of net present value (NPV)."

impacts of the proposed NTE Carolinas II power plant, and the impacts to the surrounding community that would result from constructing the plant, should not be authorized by the NCUC given there is no demonstrable need for the plant's capacity. The approval of this plant when there is no need for it is not in the public interest.

Q. DOES THAT CONCLUDE YOUR TESTIMONY?

A. Yes, it does.

Attachment A						
CO_2 + Methane GHG Emission Rate, Duke Energy Carolinas 2015 Grid Power Mix Versus Proposed NTE Carolinas II Combined Cycle Plant						
Assumptions:						
1. Duke Energy Carolinas power mix, 2015: nuclear = 61%, coal = 27%, natural gas = 11%, 1% = renewable & other						
2. Bituminous coal CO2 emission factor: 2,070 lb CO2/MWh						
3. Composite (CC & CT) natural gas combustion emission factor: 999 lb CO2/MWh						
4. Methane global warming potential compared to CO2: 25x natural gas EF						
5. Natural gas (methane) leakage rate as % of natural gas combustion: 1.8% (EPA), 4.2% (Howarth average), 12% (Howarth high)						
I. 2015 Duke Energy Carolinas Power Mix, GHG Emission Rate with Methane Leakage Associated with Natural Gas Combustion						
source	fraction	GHG EF, lb/MWh	Case 1: methane leak rate = 1.8% gas usage	Case 2: methane leak rate = 4.2% gas usage	Case 3: methane leak rate = 12.0% gas usage	
nuclear	0.61	0	0	0	0	
coal	0.27	2,070	559	559	559	
natural gas	0.11	999	110	110	110	
methane		24975	49	115	330	
Total GHG emissions, 2015 DEC grid power, lb/MWh:			**718**	**784**	**998**	
II. NTE Carolinas II Combined-Cycle Plant, GHG Emission Rate with Methane Leakage Associated with Natural Gas Combustion						
source	fraction	GHG EF, lb/MWh	Case 1: methane leak rate = 1.8% gas usage	Case 2: methane leak rate = 4.2% gas usage	Case 3: methane leak rate = 12.0% gas usage	
natural gas	1.00	819	819	819	819	
methane		20475	369	860	2457	
Total GHG emissions, NTE Carolinas II CC plant, lb/MWh:			**1188**	**1679**	**3276**	
		Source				
Duke Energy Carolinas power mix		DEC 2016 IRP Annual Report, Sept 1, 2016, p. 80.				
2,070	lb CO2/MWh	EIA, Frequently Asked Questions, Feb. 29, 2016: https://www.eia.gov/tools/faqs/faq.cfm?id=74&t=11				
999	lb CO2/MWh	California Energy Commission, Thermal Efficiency of Gas-Fired Generation in California: 2014 Update, September 2014,Table 1, p. 1. (note - no similar document found for NC gas-fired generation)				
		Composite California 2013 natural gas-fired combustion heat rate = 8,537 Btu/kWh. Therefore, 8,537 Btu/kWh × 1000 kW/MW × 117 lb CO2/10^6 Btu = 999 lb/MWh.				
25x	natural gas EF	EPA 2014, Emission Factors for Greenhouse Gas Inventories				
117	lb/MMBtu	natural gas CO2 emission rate				
7 MMBtu/MWh		combined cycle unit heat rate				
819	lb CO2/MWh	combined cycle unit CO2 emission rate				