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BEFORE THE NORTH CAROLINA UTILITIES COMMISSION
DOCKET E-7, SUB 1032

Testimony of Isaac Panzarella
On Behalf of the North Carolina
Sustainable Energy Association and Environmental Defense Fund

August 7, 2013

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

A. My name is Isaac Panzarella. My business address is 1575 Varsity Drive, Raleigh, NC 27695.

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

A. I am employed by the North Carolina Solar Center at North Carolina State University ("NC State"), where I serve as Director of the U.S. Department of Energy's Southeast Clean Energy Application Center ("SE-CEAC").

Q. WOULD YOU BRIEFLY DISCUSS YOUR EDUCATION AND EXPERIENCE?

A. I graduated from NC State with a Bachelors of Science in Mechanical Engineering. After graduating from NC State, I worked as an engineering consultant from 1998 to 2010, and for six years of those years I operated my own practice, providing engineering consulting services on high performance commercial, industrial and institutional projects, including a number of grid connected distributed generation systems. I have been licensed as a Professional Engineer in the State of North Carolina for the past ten years.

For the last three years, I have managed the Clean Power and Industrial Efficiency Project team at the North Carolina Solar Center. Under this project, I work with industrial and commercial energy end-users, utilities, state energy offices, state legislators and state regulators in a nine state Southeast region that includes North Carolina. During this time, my chief responsibility has been to serve as Director of the Southeast Clean Energy Application Center ("SE-CEAC"), which provides targeted education, unbiased information and project technical assistance in the areas of combined heat and power ("CHP"), waste heat to power and district energy.

Q. WHAT IS THE PURPOSE OF YOUR TESTIMONY IN THIS PROCEEDING?

A. The purpose of my testimony is to (1) provide a brief overview of combined heat and power ("CHP"), including its potential in North Carolina; (2) explain how development and incorporation of a CHP incentive program in Duke Energy Carolinas, LLC's ("Duke" or the "Company") portfolio could yield capacity and energy savings; (3) highlight how Duke's apparent exclusion of a type of CHP – topping-cycle CHP – from eligibility for its programs is not appropriate; and (4) request that the Commission strongly encourage Duke to introduce CHP as a topic for discussion in the Duke Collaborative and direct Duke to report back to the Commission on the Duke Collaborative's initial conclusions regarding the feasibility of a CHP incentive program.

Q. WHAT IS COMBINED HEAT AND POWER?

A. Combined heat and power ("CHP"), also known as cogeneration, is an energy efficient approach to generating electricity and useful thermal energy from a single fuel source at the point of use. An industrial or commercial facility can utilize an on-site CHP system to provide both their thermal and electricity requirements from a single fuel source, instead of utilizing electricity produced at a central station power plant and burning fuel in an on-site furnace or boiler to produce the required thermal energy. An on-site CHP system sized properly for the thermal load of the industrial or commercial facility can provide both electricity and thermal energy at an efficiency of 75% versus the combined efficiency of the conventional method which is approximately 45%. As a result of this efficiency, CHP systems can provide significant emission advantages over the conventional method of providing electricity and thermal requirements via separate systems.

Q. WHAT ARE THE BENEFITS OF COMBINED HEAT AND POWER?

A. As an energy efficient technology, CHP can provide benefits to both businesses and utilities in North Carolina. For businesses, properly sized and installed CHP systems can:

- Make them more competitive by reducing their overall energy costs;
- Reduce the risk of electric grid disruptions by enhancing electricity reliability;

• Provide stability in the face of uncertain electricity prices; and

• Reduce overall emissions of greenhouse gases and hazardous air pollutants.

For utilities, CHP systems can:

• Offer a low-cost approach to new electricity generation capacity;

• Lessen the need for new transmission and distribution infrastructure;

• Enhance power grid security; and

• Contribute to meeting energy efficiency targets.

Q. ARE THERE DIFFERENT TYPES OF CHP?

A. Yes. There are basically two types of CHP: Topping-cycle CHP and bottoming-cycle CHP.

Q. CAN YOU BRIEFLY DESCRIBE EACH TYPE?

A. Yes. In a *topping-cycle* CHP system, sometimes referred to as "conventional" CHP, fuel is combusted in a prime mover such as a gas turbine, micro-turbine, reciprocating engine, or fuel cell for the purpose of generating both electricity and thermal energy. The thermal energy, which comes from using the heat that would otherwise be lost in the prime mover's hot exhaust or cooling systems is recovered to provide process or space heating, cooling, and/or dehumidification. Optimally-efficient topping-cycle CHP systems are typically designed and sized to meet a facility's baseload thermal demand. In a *bottoming-cycle* CHP system, also referred to as waste-heat-to-power ("WHP"), the CHP system takes advantage of heat that is

generated as part of an industrial process and would normally be vented to the atmosphere. In the WHP process, a portion of the waste heat from the industrial process is recovered and typically used to produce high-grade steam through a heat recovery steam generator, and then a steam turbine utilizes the steam to generate electricity. Under ideal circumstances, WHP systems are a particularly beneficial form of CHP in that they utilize heat that would otherwise be wasted from an existing thermal process to produce electricity with a minimal amount of additional fuel.

Q. WHAT IS THE EXISTING CHP CAPACITY IN NORTH CAROLINA?

A. In North Carolina today, there are 66 CHP systems in operation totaling 1,540 MW of electric nameplate capacity. Most of these CHP systems are located at large industrial and manufacturing sites, with some CHP at agribusiness sites and institutional sites, including military installations and university campuses. Of the 66 CHP systems, 62 are topping-cycle and four are bottoming-cycle.

Q. IS THERE POTENTIAL FOR ADDITIONAL CHP DEVELOPMENT IN NORTH CAROLINA?

A. Yes, there is a large amount of potential for new CHP in North Carolina. Since 2006, an estimated 3.5 GW of new CHP capacity has been installed in the United States. The markets with the greatest CHP growth during this time

have been paper manufacturing, colleges/universities, food processing plants, chemical plants, refining operations, utilities and hospitals. Many of these markets are present in North Carolina, and represent stable and some growing industry and institutional sectors. Working with ICF International ("ICF"), SE-CEAC recently investigated the technical potential for new topping-cycle CHP in North Carolina. Technical potential is defined by ICF as the total electric generating capacity potential from existing and new facilities that are likely to have the appropriate physical electric and thermal load characteristics that would support a CHP system with high levels of thermal utilization. ICF and SE-CEAC estimated that there is approximately 6,428 MW of new topping-cycle technical potential in North Carolina of which roughly 4,667 MW resides in the industrial sector and 1,761 MW resides in the commercial sector.

Q. DOES CHP MEET THE DEFINITION OF ENERGY EFFICIENCY IN NORTH CAROLINA?

A. Yes. North Carolina General Statute §62-133.8(a)(4) states that an "energy efficiency measure" means "an equipment, physical, or program change implemented after January 1, 2007, that results in less energy used to perform the same function" and "includes, but is not limited to, energy produced from a combined heat and power system that uses nonrenewable energy resources." North Carolina General Statute § 62-133.9(a) makes the

definition I just recited applicable in the DSM/EE cost recovery context at the heart of this proceeding.

Q. DOES DUKE ENERGY'S PROPOSED DSM/EE PORTFOLIO INCLUDE A CHP INCENTIVE PROGRAM?

A. Duke's proposed portfolio for 2014-2017 does not include a CHP incentive program. Moreover, Duke's proposed new Non-Residential Smart Saver Custom Program, Attachment G Tariff, has a statement under Incentives for Custom Projects that appears to make CHP ineligible: "Electric generation, from either non-renewable or renewable sources, are not considered energy efficiency measures and therefore do not qualify for these payments." The tariff for the 2009-2013 Non-Residential Smart Saver Custom Program did not have this specific exclusion.

Q. HOW WOULD A CHP INCENTIVE PROGRAM FIT INTO A UTILITY PORTFOLIO?

A. When deciding whether CHP should be an allowable technology in a utility incentive program, there are several considerations and an opportunity to learn from what other utilities and states have done. Operating at 65% to 80% efficiency, CHP systems are effective energy efficiency measures and can provide cost-effective efficiency savings for both customer and the utility while also boosting the competitiveness of manufacturing and other energy intensive industries. CHP has been included by several states in their state

energy efficiency programs and electric utilities have successfully integrated these programs into their multi-year plans.

Though there is no universal method for including CHP in an incentive program, the states of Maryland, Massachusetts, Connecticut and Ohio provide examples of different ways that CHP benefits can be quantified. In Maryland, on April 13, 2012, the Potomac Electric Power Company ("Pepco"), Delmarva Power & Light Company ("Delmarva") and Baltimore Gas and Electric Company ("BGE") jointly filed a request for approval to provide a CHP incentive program for their commercial and industrial customers. In Maryland, PSC Commission Order 84955, dated June 5, 2012, the Commission approved the companies' proposed CHP incentive program as filed. The program terms stipulate that CHP systems must meet a minimum efficiency of 65% and pass a modified Total Resource Cost (TRC), with separate valuations for the on-peak and off-peak operation of the CHP system, placing a higher weight on on-peak energy savings. A total combined budget of $20,000,000 was approved for the CHP incentives under the companies' programs. The incentive structure includes an up-front payment of $250/kW of capacity, and an incentive of $0.07/kWh the system saves for the first 18 months of operation. In the first solicitation for participants, which closed on December 21, 2012, BGE received 16 proposals from a variety of commercial and industrial customers, for a total of 13 MW of CHP and 102,000 MWh savings. Information on the number or

scale of proposals received by Pepco and Delmarva is not available at this time.

The state of Massachusetts uses a performance-based incentive program in which efficiency credits are allocated on the basis of one credit per MWh of net fuel source savings. Fuel source savings are determined by metering the CHP generated electrical and useful thermal energy as well as the fuel energy consumed and comparing the CHP fuel energy consumed with what would have been needed to generate an equal amount of electricity by the grid and thermal energy from a boiler or furnace. An empirical formula is used to quantify the net source fuel reduction.

The state of Connecticut credits all electricity produced (kWh) by qualified CHP systems that meet or exceed the minimum efficiency threshold of 50%. In Washington State, CHP systems must have a useful thermal output of at least 33% to qualify. In Ohio, recently passed legislation (SB 14 315) allows CHP systems to participate in the state's efficiency program if they have an overall efficiency of at least 60%, with at least 20% of total energy output as thermal energy. The details on calculating CHP savings are currently being finalized by the Public Utility Commission of Ohio.

Q. HAS SE-CEAC WORKED WITH DUKE TO EXPLORE CHP OPPORTUNITIES IN NORTH CAROLINA?

A. SE-CEAC has been part of a working group convened by Duke in January 2012 to investigate CHP opportunities in North Carolina. The group was

formed after a conference in November 2011 on CHP in North Carolina. At this conference, which had over 70 attendees including large energy-users, SE-CEAC's data on CHP technical potential in North Carolina was presented. The CHP working group was started and managed by Karim Ly, Senior Marketing Manager with Duke Energy, with the intention of realizing a profitable and viable CHP incentive program for the Company. This working group has advised Duke on examples of CHP programs in other states and on aspects of the design for a potential CHP incentive program for Duke. Part of my role as Director of SE-CEAC was to help Duke identify potential pilot sites in North Carolina from among the sites we provide CHP technical assistance to. If our site assessments showed a viable CHP opportunity and interest in a utility incentive program, we obtained their permission to share their contact information with Duke. From there, Duke and the sites worked together directly to evaluate whether the CHP opportunity met Duke's criteria for a pilot site.

Q. WHAT IS THE STATUS OF THE DUKE CHP WORKING GROUP YOU JUST REFERRED TO?

A. Duke's CHP working group has been inactive for the past 9 months due to the departure of Senior Marketing Manager Karim Ly in September of 2012. My understanding is that Duke staff were reassigned to work on the project in early 2013 but the Duke CHP working group has not been re-convened.

Q. PLEASE COMMENT ON DUKE'S RESPONSE TO NCSEA'S DISCOVERY REQUEST RELATED TO CHP?

A. Duke's response to NCSEA's Data Request No. 3-23 is attached to my testimony as Exhibit 1. In the response, Duke responds to the question, "Have you considered or investigated the feasibility of offering a combined heat and power (CHP) program? If so, please provide a summary of the results of your consideration/investigation." Duke's response, in part, reads as follows: "[T]he Company has collaborated with external stakeholders with the hope of identifying one or more customers that are considering a CHP investment and are willing to act as a test case for the incentive design. Unfortunately, to date, no suitable candidates have been identified, however the Company remains interested in exploring a CHP incentive program if one or more test cases emerge." The stakeholder group Duke refers to in its response is the same working group that SE-CEAC was participating in. Although SE-CEAC and the other stakeholders provided Duke with a number of customer contacts that were interested in a CHP project investment, Duke states that no suitable candidates had been identified.

Q. CAN YOU EXPLAIN WHY DUKE WAS UNABLE TO IDENTIFY ANY SUITABLE CANDIDATES?

A. SE-CEAC followed-up with several of the industrial, commercial and institutional customers that were put in touch with Duke's CHP team. Based on follow-ups with representatives of two of these customers, it is my

impression that Duke considers only sites with bottoming-cycle CHP applications to be eligible for incentives in North Carolina and that customer applications for topping-cycle CHP systems are not eligible for an incentive because they generate electricity using a nonrenewable fuel. As I stated in an earlier answer, North Carolina law allows for CHP as an energy efficiency measure under a utility cost recovery program even if the CHP uses a nonrenewable energy resource.

Q. DO YOU BELIEVE THAT A CHP INCENTIVE CAN DECREASE OPT-OUT OF LARGE ENERGY-USERS FROM A UTILITY'S PORTFOLIO OF PROGRAMS?

A. Yes. SE-CEAC provides technical services to potential CHP candidates, including large industrial and institutional energy-users who typically opt-out of utility energy efficiency programs. During the period starting October 1, 2011 and ending September 30, 2012, SE-CEAC performed technical evaluations for four potential CHP projects in North Carolina. Two of these projects were at industrial sites, with potential natural gas-fired CHP capacities of 10 MW and 4.7 MW, having estimated payback periods between three and five years. The current prevailing practice among industrial companies that we have spoken to is to pursue projects that have less than a two-year payback due to limited internal capital. If an incentive program were offered for CHP projects that could help produce payback periods of approximately two years or less, I believe that could lead

industrials to opt-in to the program to pursue projects eligible for the CHP incentive. The level of increased participation achieved would depend on the level of incentive offered and terms of the program.

Q. WHAT IS YOUR RECOMMENDATION TO THE COMMISSION?

A. I have two recommendations. First, I recommend that the Commission strongly encourage Duke to introduce CHP as a topic for discussion in the Duke Collaborative and direct Duke to report back to the Commission on the Duke Collaborative's initial conclusions regarding the feasibility of a CHP incentive program. Second, I recommend that the Commission reinforce that both topping-cycle CHP and bottoming-cycle CHP qualify as energy efficiency measures per North Carolina law.

Q. DOES THIS CONCLUDE YOUR TESTIMONY?

A. Yes.

DUKE ENERGY CAROLINAS

Request:

Have you considered or investigated the feasibility of offering a combined heat and power (CHP) program? If so, please provide a summary of the results of your consideration/investigation.

Response:

Duke Energy has investigated the viability of an energy efficiency incentive program to promote commercial and industrial customer adoption of combined heat and power (CHP) systems. Similar to Duke Energy Carolinas' Smart$aver custom incentive program, the concept that the Company has explored involves the payment of incentives to customers that install and own a CHP system based on the verified energy and demand savings that result from the increased electric efficiency of the CHP system. Because it is not possible to produce a theoretical analysis model that accurately represents the wide range of customers' unique financial, electric and thermal needs, the Company has collaborated with external stakeholders with the hope of identifying one or more customers that are considering a CHP investment and are willing to act as a test case for the incentive deign. Unfortunately, to date, no suitable candidates have been identified, however the Company remains interested in exploring a CHP incentive program if one or more test cases emerge.