OFFICIAL COPY

BEFORE THE NORTH CAROLINA UTILITIES COMMISSION
DOCKET E-7, SUB 1050

TESTIMONY OF ISAAC PANZARELLA
ON BEHALF OF THE
N.C. SUSTAINABLE ENERGY ASSOCIATION

May 19, 2014

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"). Among my duties, I serve as Director of the U.S. Department of Energy's Southeast Combined Heat and Power Technical Assistance Partnership ("Southeast CHP TAP").

Q. **WOULD YOU DISCUSS YOUR EXPERIENCE AND EDUCATION?**

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 energy efficiency assessments. I have been licensed as a Professional Engineer in the State of North Carolina for the past eleven years.

For the last four years, I have managed the Clean Power and Industrial Efficiency Project team at the North Carolina Solar Center. Under this project, I am responsible for outreach, education and technical assistance on distributed energy and energy efficiency in North Carolina and work with other experts in the Southeast and across the United States. My resume is attached hereto as **Exhibit IP-1**.

Q. WHAT IS THE PURPOSE OF THE SOUTHEAST CHP TAP?

A. The Southeast CHP TAP 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. This partnership effort involves industrial, institutional, and commercial energy end-users, utilities, state energy offices, state legislators and state utility regulators in a ten state region of the Southeast United States that includes North Carolina.

Q. HAVE YOU PREVIOUSLY TESTIFIED BEFORE THE NORTH CAROLINA UTILITIES COMMISSION ("COMMISSION")?

A. Yes. I testified about CHP on behalf of the North Carolina Sustainable Energy Association ("NCSEA") and Environmental Defense Fund in Docket No. E-7, Sub 1032, which addressed the application of Duke Energy Carolinas, LLC ("DEC") for approval of a new cost recovery mechanism and portfolio for demand-side management and energy efficiency.

Q. WHAT OCCURRED AS A RESULT OF OR IN CONNECTION WITH YOUR PREVIOUS TESTIMONY BEFORE THIS COMMISSION?

A. Most of the parties in Docket No. E-7, Sub 1032 entered into a stipulated settlement. As described on page 12 of the Public Staff's September 26, 2013 *Proposed Order* filed in that docket, the stipulated settlement provided that CHP was to be discussed in DEC's Carolinas Energy Efficiency Collaborative ("Collaborative") no later than December 31, 2013 with the results of the discussion (or a status update) being reported to the Commission in this docket.

Q. HAS DEC PROVIDED A REPORT ON ANY CHP DISCUSSION AT THE COLLABORATIVE?

A. Yes, DEC has provided a status update in this docket. On pages 32-33 of the pre-filed direct testimony of DEC Witness Tim Duff, he states:

> During the discussion of CHP, information was presented to the Collaborative by both a Company expert and an external expert from North Carolina State University. Collaborative members seemed to agree that there is significant opportunity around CHP, but also that there are significant structural barriers to the opportunity related to up-front capital costs and the impending expiration of the North Carolina tax credit for CHP. The other issue that was discussed was the need to structure a CHP program with a multi-year performance contract in order to ensure that the actual hours of operation align with the hours of operation projected for the project. All parties agreed that further discussion regarding a CHP-focused program may be warranted, but in the interim agreed that the Company would work under its existing Non-Residential Smart $aver® Custom Program to meet the needs of any customer that expresses an interest in a CHP project that meets the eligibility requirements.

Q. PLEASE PROVIDE, FROM YOUR PERSPECTIVE, A SUMMARY OF THE DISCUSSION OF CHP THAT TOOK PLACE AT THE COLLABORATIVE.

A. First, to be clear, I am the "external expert from North Carolina State University" referred to in DEC Witness Tim Duff's pre-filed testimony. During my presentation to the Collaborative, I presented estimates prepared by ICF International at the end of September 2013 that indicate 4,072 MW of technical potential for CHP in non-residential applications in North Carolina. The large majority of this potential, 3,465 MW, is present in applications that require concurrent electricity and thermal energy in the textiles, chemicals, paper, commercial buildings, colleges and universities, hospitals, government buildings, lumber and wood, rubber and plastics, schools, food processing, military and prison sectors. The majority of participants in the meeting appeared to agree that this potential presents a significant opportunity around CHP.

With regard to the design of a CHP pilot or initiative, the Collaborative discussed CHP energy efficiency incentives in other states, including Maryland, where commission approval for CHP energy efficiency cost recovery was sought and granted to three utilities under what is known as the "EmPOWER Maryland CHP Program." Under the EmPOWER Maryland CHP Program, Baltimore Gas and Electric ("BGE") – one of the three utilities – initiated a CHP program with an incentive payment structure

consisting of an up-front payment of $250/kW of capacity and an incentive of $0.07/kWh that the system saves during the first 18 months of operation. The other two Maryland utilities – Pepco and DelMarva Power – initiated CHP programs with similar terms. The Collaborative appeared to generally agree that the EmPOWER Maryland CHP Program type of structure, with up-front and performance incentives, balances the need to encourage program participation while sharing the potential project risk.

The evidence supporting creation of the BGE CHP program indicated that for a three-year period, a program supporting 20 MW of CHP projects with a budget of $10.4 million was cost effective under the Total Resource Cost ("TRC") test with a score of 2.11. This falls within the range of TRC scores, 1.02 to 2.94 that DEC estimates for its proposed non-residential energy efficiency programs during 2014, per DEC Witness Tim Duff's pre-filed Exhibit 7, and serves to illustrate that cost effective CHP pilots and initiatives are possible.

As further evidence that cost effective CHP programs are possible, BGE received over 20 applications in the initial CHP program offering and accepted 11 participants. In July 2013, BGE requested commission approval to increase the program budget by $10.8 million to fund a second offering, to support 12 additional participants. The Maryland commission considered and approved the second offering request.

At the Collaborative, there was also discussion of the up-front cost of CHP as a barrier to end-user investment in this energy efficiency technology. The common understanding is that industrial and commercial customers are seeking energy efficiency projects with a two to three year payback. Much of the CHP potential has higher payback periods than this, making it unlikely that these investments will be made without incentives based on the shared savings.

Q. HOW MUCH TIME WAS DEDICATED TO THE CHP DISCUSSION AT THE COLLABORATIVE MEETING?

A. While my summary of the discussion could make it appear as though a great deal of time was spent discussing CHP, in actuality, only about one hour was spent discussing CHP at the December 2013 Collaborative meeting. This was a reasonable allocation of time at a quarterly Collaborative meeting where many topics are discussed. However, it was not an adequate amount of time for a full discussion and thorough consideration of the "significant opportunity around CHP" or the "barriers to the opportunity" referred to in DEC Witness Tim Duff's pre-filed testimony.

Q. WHAT DO YOU PERCEIVE AS THE MOST IMMEDIATE "BARRIERS TO THE [CHP] OPPORTUNITY?"

A. While up-front cost and payback period will have to be addressed, I see two more immediate "barriers" that are being created by uncertainty.

First, in North Carolina, most of the non-residential technical potential for CHP that I mentioned earlier is "topping cycle" CHP.[1] I believe "topping cycle" CHP is eligible for participation in any CHP pilot or initiative (I will note for the Commission that excluding "topping cycle" CHP from eligibility to participate in any pilot or initiative would significantly restrict the number of customers who could participate in the pilot or initiative). Other stakeholders may disagree about the eligibility of "topping cycle" CHP. Certainty on this question would aid the stakeholders' discussions.

Second, stakeholders lack of a clear method to calculate the energy efficiency savings from CHP systems. For context, there are two prevailing methods to calculate the savings from CHP systems in energy efficiency programs and resource standards. The first method defines CHP energy efficiency as all electricity output from CHP systems that meet an acceptable efficiency level. In Connecticut, for example, all kWh produced by a CHP system at a retail customer's site that has a minimum overall efficiency of 50% are counted. The second method defines CHP energy efficiency as the reduction in source fuel that results from operation of CHP at a retail customer's site. The source fuel reduction is determined by metering the useful electric and thermal output from a CHP system and comparing the CHP fuel consumed to the fuel that would be expended to provide the same amount of electricity from utility grid generation and an onsite boiler, furnace or process heater.

[1] A definition of "topping cycle" CHP can be found in the testimony I provided in Docket No. E-7, Sub 1032 at page 4 of my pre-filed testimony.

Massachusetts uses this approach and uses 33% as the fuel efficiency value for grid generation and 80% as the fuel efficiency for a typical boiler. The benefit of this method is that the savings for CHP systems are directly proportional to the efficiency of the systems. It is unclear which method is to be applied in North Carolina. Without a clear and accepted method in North Carolina, it is difficult to determine the cost effectiveness of any proposed CHP pilot or initiative.

Q. BEFORE YOU MAKE YOUR RECOMMENDATIONS TO THE COMMISSION, IS THERE ANYTHING ELSE YOU WOULD LIKE TO SHARE?

A. Yes. I think it is important for the Commission to understand that stakeholders, including the Southeast CHP TAP and me, have been working with DEC for several years now in an effort to find a way to seize the "significant opportunity around CHP" in North Carolina. Some of these efforts took place as part of a CHP Working Group, which was not part of the Collaborative. The CHP Working Group no longer exists. In an effort to assist Commission- and stakeholder-understanding of some of the CHP Working Group discussions, I have attached hereto, as **Exhibit IP-2**, DEC's response to NCSEA's Data Request No. 2-1. **Exhibit IP-2** contains CHP Working Group information that, to my knowledge, is not publicly available elsewhere. I think this CHP Working Group historical information is helpful because, for example, it outlines a possible stakeholder process that begins

with reaching consensus on the desired cost effectiveness of a CHP energy efficiency pilot program, followed by determination of appropriate incentives that would be offered to potential pilot program participants.

Q. DO YOU HAVE ANY RECOMMENDATIONS FOR THE COMMISSION?

A. Yes. I have two recommendations.

Q. WHAT IS YOUR FIRST RECOMMENDATION?

A. I believe the discussion of CHP taking place at the Collaborative should continue. The participants in the December 2013 meeting seemed to agree that there is value in continuing the discussion. The Commission should encourage the discussion of CHP to continue at the Collaborative.

Q. WHAT IS YOUR SECOND RECOMMENDATION?

A. I believe the discussion of CHP at the Collaborative should be supplemented with at least one stakeholder meeting that is dedicated solely to discussing CHP. I hold this belief for several reasons. First and foremost, CHP is a complex topic and seizing the opportunity around CHP will require more than an ongoing quarterly one-hour discussion at the Collaborative. Second, the Collaborative does not permit attorney attendance. The stakeholders' attorneys can, however, play a constructive role. At a meeting outside of the Collaborative, the attorneys could help all of the stakeholders better

understand the two most immediate barriers that I identified: (1) The uncertainty around "topping cycle" CHP eligibility, and (2) the uncertainty around how to calculate CHP energy efficiency savings. A stakeholder meeting attended by attorneys would help the stakeholders better understand these issues and, to the extent the Commission can provide certainty, could help the stakeholders come to consensus on the best method for bringing these issues before the Commission. Third, a separate stakeholder meeting to discuss CHP would provide the opportunity for several end-users to participate in the discussion. The Southeast CHP TAP has held stakeholder workshops that have involved end-users from industrial sites in the pulp and paper, food and beverage, textiles and chemical sectors, as well as institutional and commercial sites. These companies represent potential CHP program participants and would provide valuable input with regard to the design of a pilot or initiative. Finally, I believe the stakeholder process envisioned by DEC for the CHP Working Group could be discussed at a meeting dedicated solely to CHP and, if adopted in whole or in part, could help secure a CHP energy efficiency pilot program design that has support from multiple stakeholders. The Commission should direct the parties to convene a stakeholder discussion within the next three months for the sole purpose of discussing CHP in North Carolina.

Q. DOES THIS CONCLUDE YOUR TESTIMONY?

A. Yes.

EXHIBIT IP-1

Isaac Panzarella, PE, DGCP, LEED™ AP
North Carolina State University
North Carolina Solar Center
telephone: (919) 515-0354
ipanzarella@ncsu.edu

Education and Training

BS, North Carolina State University, Mechanical Engineering 1998

AS, Kettering University, Mechanical Engineering, 1995

LEED Accredited Professional, United States Green Building Council, 2002

Professional Engineer Licensure, State of North Carolina, #28923, 2003

Professional Experience

September 2010- present – Director and Principal Investigator, U.S. DOE Southeast Combined Heat and Power Technical Assistance Partnership– responsible for project management, grant administration, planning and oversight of execution of outreach, policy education and technical assistance efforts

July 2010 – September 2013 – Co-Director US DOE Southeast Center for Industrial Energy Intensity Reduction, a U.S. DOE Save Energy Now Regional Partnership

May 2010 – present – Clean Power & Industrial Efficiency Project Coordinator, North Carolina Solar Center, College of Engineering at North Carolina State University, Raleigh, NC

August 2003- April 2010 –President and Chief Engineer – Consider Design, PA, Raleigh, NC, High Performance Building Systems & Renewable Energy Design

November 1998- July 2003 – Partner and Design Studio Manager, Padia Consulting, Inc., Cary, NC

January 1995 – July 1997 – Quality Engineering Associate, GKN Automotive, Sanford, NC

September 1991 – December 1994 – Engineering Intern, Manufacturing Engineering, Quality Assurance, Research Lab, Harrison Division of General Motors, Lockport, NY

Select Publications

Panzarella, I., 2004 "Ecohousing for the Majority Market", American Solar Energy Society 2004
Panzarella, I., 2001 "Factory of the Future" (Carrier Corporation), International Building Energy Simulation Conference, Porto Alegre, Brazil

Synergistic Activities

2008 Spring	NC State University, College of Design	Architectural Design Studio Adviser
2007-2008	UNC-Chapel Hill, Environmental Studies	Sustainable Design Seminar Guest Lecturer
2006-2007	NC State University, College of Design	Graduate Sustainability Seminar Adviser
2006 Spring	NC State University, College of Design	Architectural Design Studio Adviser
2006 Spring	NC State University, College of Design	Architectural Technology Guest Lecturer

EXHIBIT IP-2

DUKE ENERGY CAROLINAS

Request:

The following requests are submitted in an effort to resolve DEC's objections to certain data requests contained in NCSEA's first set of data requests:

a. Please provide the compiled "informational reports and studies" referenced in the DEC DR 1-2 response.

b. For DR 1-3, please provide, in the aggregate, a list of the number of customers who approached Duke about CHP during the 2012 and 2013 exploratory CHP "program design" discussion.

c. In connection with DRs 1-3 to 1-5, please provide the last two versions of the exploratory CHP "program design" document.

d. In connection with DR 1-6, please provide any preliminary cost effectiveness analysis DEC completed in connection with the exploratory CHP "program designs." (It is hoped that, at a minimum, any disclosed document will identify/characterize the critical factors DEC examines in evaluating the cost effectiveness of a CHP program).

Response:

A. The attached file named Coal Retirements CHP Investment Opportunities is the study/report referenced in DEC DR 1-2 response.

B. Duke had discussions with four customers. Because each of those discussions were only preliminary in nature and revealed significant barriers, Duke did not retain documentation of those discussions. Furthermore, the identity of those customers is not being disclosed to protect their commercial interests. The recollection of the Duke participant(s) still employed by the Company is as follows:

Response Continued:

One customer opportunity was deemed not be viable for a pilot test case because the customer indicated that their interest in CHP in the Duke territory was being driven by a larger corporate initiative, and that the customer was likely to continue its pursuit of CHP opportunities regardless of whether Duke Energy were to offer incentives. Therefore, Duke representatives were concerned that a pilot project with this customer would fail the free-ridership test. Two customers were proposing to use biogas-fired processes, which are designated for possible renewable energy credits under NC Senate Bill 3 and therefore not eligible for energy efficiency incentives. The fourth customer was proposing to expand an existing biogas-fired CHP facility. The customer did not definitively indicate that the additional CHP capacity would not be biogas-fired, therefore it was unclear whether the expansion would qualify for energy efficiency incentives. Duke had informal discussions with external parties to gain their perspective on the question of whether incentives could be applied to the pro-rata non-renewable energy portion of a CHP installation, however no definitive answers have been obtained.

C. See the attached files named DRAFT- Duke Energy Proposed CHP Pilot Guidelines V2 and DRAFT- Duke Energy Proposed CHP Pilot Guidelines V3. These documents are a product of the work group and do not reflect an energy efficiency program design or proposed offering by Duke Energy Carolinas.

D. DEC has not performed analysis to determine the cost effectiveness of a CHP program offering. The total program cost in comparison to the avoided cost benefit will drive the overall cost effectiveness. The working group discussed a pay-for-performance model under which the incentive would be calculated uniquely for each project based on the verified energy and capacity savings each year. In such a model, the desired cost-effectiveness is an input to the calculations, rather than a result. It was Duke's vision that the working group and other stakeholders would reach a consensus on the desired cost effectiveness of the pilot program, which would then be used to determine the size of the incentives that could be offered. The attached file named Two Incentive Options is a product of the work group and does not reflect an energy efficiency program design or proposed offering by Duke Energy Carolinas. This file shows for illustrative purposes results of two incentive payment options. Option 1: 100% pay as we go and Option 2: Upfront incentive payment and pay as we go.


Coal Retirements CHP Investment Opp


DRAFT - Duke Energy Proposed CHP


DRAFT- Duke Energy Proposed CHP Pilot G


Two incentive Options.xlsx

The first attachment, *Coal Retirements CHP Investment Opp*, in NCSEA DR No. 2-1, can be accessed online at:

http://www.aceee.org/sites/default/files/publications/researchreports/ie123.pdf.

Draft Version 3.0

Proposed Duke Energy CHP Pilot Program - A brief Overview

Table of Contents

Contents

1. Eligibility:

a. Eligible Customers

All Duke Energy (pre-merger) NC customers opted-in our EE programs at the time of submitting and receiving approval to participate in the pilot program. Customers are required to continue participating our EE program (and paying the EE rider) in order to receive our performance based incentive payment.

b. Eligible Technologies

- All top-cycled CHP technologies using fossil fuels or renewable fuels such as Biogas, Methane, and Biomass wood waste.
- All bottom-cycle CHP and Waste heat recovery technologies.
- The CHP system must:
  - ✓ Demonstrate a minimum annual fuel conversion efficiency of 60% Higher Heating Value (HHV) at design
  - ✓ Have a NO_x emission rate lower than, or equal to, 1.6 lbs./MWh
  - ✓ Have a CO_2 emission rate lower than 800 Kg/MWh.
- PURPA QFs (Qualifying Facilities) are not eligible to participate in this program. They are required to be on purchased power rate (PP-H, PP-N or Buy-All/Sell-All) and therefore do not provide a basis for receiving an incentive. This program only pays an incentive for the energy produced with CHP and consumed onsite.

2. Incentive Level:

Customers who sign-up to participate in our CHP energy efficiency program will receive, from Duke Energy, a performance-based incentive payment at the end of each month during an initial contract period of 5 years. Customers will be paid monthly on a projected energy production kWh, with a quarterly M&V and true-up process to reconcile "projected avoided cost" and "actual avoided costs". Customers will be required to report planned outages at least one month ahead of the event, and unplanned outages as they occur, so that Duke has the ability to adjust monthly incentive payments to minimize the magnitude of the quarterly true-up.

The performance incentive will only be applied to the electric energy produced by the CHP/HR plant and used onsite by the customer to reduce its electricity purchased from the Duke Energy system. All incentive payments will be subject to a measurement and verification (M&V) protocol to be defined by Duke Energy.

The incentive structure will consist of a variable (based of the time of production/use) $/kWh of energy produced (and consumed onsite) subject to annual revisions based on changes of Duke Energy's avoided cost of delivering energy. Our regulatory filling of this program with the NCUC will specify the percentage of avoided cost that Duke Energy will share with program participants. The table below is an illustration of the structure of the incentive schedule that will be offered to customers.

	Summer Months		Winter Months	
	1:00 p.m. to 9:00 p.m. (same day)	9:00 p.m. to 1:00 p.m. (next day)	6:00 a.m. to 1:00 p.m. (same day)	1:00 p.m. to 6:00 a.m. (next day)
Transmission Served	A $/kWh	B $/kWh	C $/kWh	D $/kWh
Distribution Served	E $/kWh	F $/kWh	G $/kWh	H $/kWh

DETERMINATION OF ON-PEAK AND OFF-PEAK HOURS

On-Peak Period Hours

Summer Months

June 1 – September 30 | Monday – Friday | 1:00 p.m. – 9:00 p.m.

Winter Months

October 1 – May 31 | Monday – Friday | 6:00 a.m. – 1:00 p.m.

Off-Peak Period Hours:

All other weekday hours and all Saturday and Sunday hours. All hours for the following holidays shall be considered as Off-Peak: New Year's Day, Memorial Day, Good Friday, Independence Day, Labor Day, Thanksgiving Day, Day after Thanksgiving, and Christmas Day.

Once our economic analysis completed, we will provide actual numbers for incentives amounts that customers will be eligible to receive under this program.

Table 1

3. Contract Renewal:

At all times during the effective contract period, participation in our EE programs will be required. Failure to opt-into our EE programs during annual renewals or at any point during the contract will result in forfeiting eligibility to receiving incentive payments from DUKE.

The initial contract period will be of 5 years. After the first 5-year initial contract period, each year, DUKE and the program participant must mutually agree to renew their contract for a 1-year term, provided customers meet a minimum CHP production capacity factor of 50% during the prior 12-month period.

Duke Energy alone will have the option to terminate the contract if at any time during the contract term regulatory approval of the program expires or is rescinded, or if Duke Energy's energy efficiency cost recovery and incentive mechanism in North Carolina expires or is rescinded without being replaced by a comparable cost recovery and incentive mechanism.

4. CHP System Size Limits:

a. Minimum size: 250 kW
b. Maximum size: 25 MW

5. Payment Structure:

a. Customers will receive monthly incentive credits calculated based on projected performance, which will be set in agreement with the customer at the start of each contract year.
b. On a quarterly basis, DUKE will compute a true-up to compare the amounts of actual incentive paid out to the amount of the incentives that should have been paid to the customer based on actual performance during the ending 3 month period.
c. At the end of each 12 month period, a final true-up will be done in order to properly settle any difference between the incentives amounts paid and amounts due to the customer.
d. Customers' monthly incentive payments will be made by check to the customer's name as recorded in the contract and the customer's Duke Energy account.

6. Export to Grid:

The intent of this program is to help customer first reduce their energy purchases from the Duke Energy system and possibility sell their excess energy production to the grid. Selling power to the grid should by no means be the primary goal for program participants. Subject to further stakeholder review, Duke is proposing that customers who elect to sell more than 25% of the energy produced with the CHP plant in any given calendar month will automatically forfeit their incentive for that month.

For example, if a customer produces 1000 MWh with CHP in April and exports 300 MWh to the grid, the customer forfeits its incentive payment for April on the 700 MWh consumed onsite. By contrast, if the customer exports 200 MWh during the month its incentive payment will be computed on the 800 MWh consumed onsite.

Customers generating power onsite in parallel with the grid must switch to rate schedule PG (parallel generation) or rate schedule HP (with their baseline set as the net load profile of their demand including CHP production). Net Exports to the grid are not permitted under either rate schedules PG or HP.

7. Interconnection and Rate Change Requirements:

Customers will be subject to all applicable interconnection requirements in place at Duke Energy. The table below includes guidelines that describe the rate schedules applicable to various interconnection scenarios and fuel sources. To be able to receive an incentive from Duke Energy, the customer's project would need to fall within one of the green boxes.

Customers will not receive an incentive under the Buy All/Sell All option because the incentive is only paid on the portion of the CHP generated energy that is used onsite to offset the customers' load. The Buy All/Sell All option (which applies to PURPA QFs) does not offset the customer load, and therefore does not result in avoided energy and avoided capacity to justify an incentive.

Also, customers who participate in our PowerShare (P/S) program and who elect to switch to rate schedule PG for the purpose of this program automatically forfeit the right to participate in our P/S program. The P/S rate schedule is not available to customers on rate schedule PG.

	Connection on the DUKE Side of Meter	Parallel Generation (Connection on the Customer side of the Meter)		
	Buy All/Sell All[1]	Net Metering (NM)	Net Metering/Sell Excess **	Parallel operation
Renewable Generation	• Customer purchases their needs on a standard rate schedule. Duke purchases the entire output under PP-N (Non-hydro), PP-H (Hydro) • The facility must not exceed a capacity of 5 MW • For facilities with capacity greater than 5 MW, a rate is negotiated with Duke • Customer retains RECS, but can also elect to sell them to Duke under a separately negotiated contract • Customer might qualify to an free allowance from the Green power ($10.MWh) while keeping their RECs	• Generator is < or = 1000 kW* • Customer is on a standard rate and uses the generation to offset load. • Excess RECs (from generation above customer's needs) are donated to Duke annually • Customer pays a standby charge for a system of capacity >100 kW (~ $1.11/kW) • Customer on TOU rates can retain RECs, otherwise Duke gets RECs	• Generator is < or = 1000 kW • Customer is on a standard rate and uses the generation to offset load. • Excess energy is purchased by Duke under Schedule PP-N • Customer pays a standby charge for a system of capacity >100 kW (~ $1.11/kW) • Customer retains RECs	• Customer is put on rate schedule PG • Excess energy is purchased under PP-N • Installed capacity must be 80 MW or less • Standby charges apply OR • Customer is put on rate schedule HP • Standby charges apply • Customer retains RECS
Other Generation (Non Renewable)	• Customer purchases its needs on a standard rate schedule. • Duke purchases the entire output under PP-N, PP-H • The facility's capacity must be 5 MW or less • For facilities with capacity greater than 5 MW, a rate is negotiated	Not available	Not available	• Customer is on rate schedule PG • Excess energy is purchased by Duke under schedule PP-N • Capacity must be < 80 MW • Standby charges apply OR • Customer is on schedule HP • Standby charges apply

8. Project Timeline/Milestones:

a. Duke Energy reserves the right to cancel the incentive contract if construction of the project is not started within 180 days from the date of the signature of the contract agreement.

b. Duke Energy reserves the right to cancel the contract if construction of the project is not completed within 731 days (2 calendar years) from the date of the signature of the contract agreement.

9. Warranty:

A minimum warrant of 10 years on the equipment and installation will be required.

10. Application Process:

The first step is for the Applicant to submit a completed application for the proposed CHP system. Applicants must also submit an engineering analysis, and an environmental assessment at the time of application. The following outlines the process for application review and approval:

a. **Eligibility Review** – Duke Energy will first review the application for program eligibility. The Applicant may be contacted for application clarification. After eligibility review, Duke Energy will issue a letter to the applicant either accepting or rejecting the application for further review. If accepted, the letter will specify which Duke Energy 3rd party technical consultant(s) is assigned to the review.

b. **Detailed application review** – The Technical Consultant will review the application and engineering analysis within 30 days and, if necessary, issue written comments to the Applicant requesting changes or clarification. The application and engineering analysis must be approved by Duke Energy.

c. **Incentive Contract** – If Duke Energy approves the customer's application, Duke Energy and the customer will enter into a binding contractual agreement ("the CHP EE Incentive Contract") that is contingent on receiving regulatory approval from the NCUC.

d. **Pre-Installation Inspection** - The Technical Consultant conducts a pre-installation Project site inspection to verify the accuracy of the information in the application with regard to both existing conditions and the feasibility of installing the proposed CHP system. Duke Energy's Technical Consultant will schedule this site visit after an initial review of the engineering analysis.

Draft

Duke Energy CHP Pilot Evaluation Guideline

Table of Contents

Contents

1. Eligibility:

a. Eligible Customers

All Duke Energy (pre-merger) NC customers opted-in our EE/DSM programs at the time of submitting and receiving approval to participate in the pilot.

b. Eligible Technologies

- All top-cycled CHP technologies using fossil fuels or renewable fuels such as Biogas, Methane, and Biomass wood waste.
- All bottom-cycle CHP and Waster heat recovery technologies.
- GHG baseline: 450 kg CO2/MWh (2011 Duke Energy Carolinas CO2 emission level). This avoided emission factor does not account for avoided transmission and distribution losses. The actual on-site emission rate that projects must beat to be eligible for pilot participation is 480 kg CO2/MWh. Eligibility is determined based on a cumulative 10 years performance. [ja1]

2. Incentive level by technology category and Cost Effectiveness Score:

Type of Technology	UCT < 3	3 < UCT < 4	4 < UCT < 5	UCT > 5
Micro turbine CHP	$/kW	$/kW	$/kW	$/kW
Steam Turbine CHP	$/kW	$/kW	$/kW	$/kW
Backpressure Turbines	$/kW	$/kW	$/kW	$/kW
Gas Turbine CHP	$/kW	$/kW	$/kW	$/kW
Internal Combustion Engine CHP	$/kW	$/kW	$/kW	$/kW

Table 1

3. [ja2]System size:

a. Minimum size: 200 kW
b. Maximum size: 10 MW

4. Payment Structure:

a. 40% upfront, [ja3]60% PBI (Performance Based Incentive) based on kWh generation of on-site load, paid over the life of the performance contract.
b. Projects will be subject to a 5% band for GHG emission rate.
c. No penalty is assessed in any year that cumulative emissions rate does not exceed 510 kg CO2/MWh.
d. PBI payments will be reduced by 25% in years where a project's cumulative emission rate is greater than 510 kg CO2/MWh but less than or equal to 600 kg CO2/MWh.
e. Projects that exceed an emission rate of 600 kg CO2/MWh in any given year will receive no PBI payments for the year.

5. Assumed Capacity Factors:

The Assumed Capacity Factor are used to determine upfront the $/kWh value of the incentive to be received by the customer for the energy used and consumed internally. If the customer operates the plant at a high capacity factor than the Assumed Capacity Factor, a higher portion of the incentive allowed is received during the year.

a. 90% assumed capacity factor for backpressure turbines.
b. 75% assumed for all other distributed energy resources (DER).
c. DER which does not achieve this capacity factor over five years will not be paid full PBI at the end of the last year if the performance contract.

6. [ja14]**Incentive Decline:**
   a. 2.50% per year for bottom-cycle CHP technologies (backpressure turbine or non-condensing turbines).
   b. 5.00% per year for top-cycle CHP.

7. [ja15]**Maximum project incentive:**
   a. $3 million per project application[ja16]

8. **Minimum customer investment:**
   a. Must be at least 25% of the total of eligible project costs. Duke Energy's portion of project cost [ja17]will be less of equal to [100% – Applicable State and Federal Investment Tax Credit (ITC) – Available Grants – 25%].
   b. Customers must demonstrate that they has applied for all available local grants that they may be eligible for before a receiving the Duke Energy incentives.

Examples of such grants include the $11.2 million allocated to the state of NC as part of the negotiated settlement by TVA with several states to address excessive air pollution from its coal-fired plants. The settlement allows North Carolina to spend the settlement money over the next five years (through 2016) on energy efficiency and renewable energy projects of the state's choosing. The state will identify and give preference to projects in the western part of the state, particularly within the Tennessee Valley Authority service area. Examples of recognized projects include Cogeneration units to produce electricity and useful heat at manufacturing plants or universities, hospitals, prisons, military bases and other institutions.

9. **Export to Grid:**
   a. A maximum of 25% of the annual energy generated by the CHP plant.
   b. In cases where a customer is exporting electricity to the grid, the PBI payment will be calculated based on annual on-site electrical consumption as opposed to the generating system's output.

10. **ESCO involvement:**
    Customers who choose to involve an ESCO (Energy Service Company) for the construction, operation and maintenance or a performance contract may be eligible to participate in the pilot as long as the project adheres to the grid export limits stipulated in the contract.[ja18]

11. **Energy Efficiency Audit and EE Investment Requirements:**
    a. Mandatory for participation in the DUKE CHP pilot unless an extensive audit has been conducted within five years of the date of the signature of the contract.
    b. Any measures with a payback period of two years or less shall be implemented prior to receipt of the third annual PBI payment.

c. Exceptions may be granted by Duke Energy, on a case by case basis, if documentation is submitted by the customer explaining why implementation of the measure(s) was not feasible.

12. [a9]Project Timeline/Milestones

a. Duke Energy reserves the right to cancel the contract if construction of the project is not started within 270 days from the date of the signature of the contract agreement.
b. Duke Energy reserves the right to cancel the contract if construction of the project is not completed within 731 days (2 calendar years) from the date of the signature of the contract agreement.

13. Warranty:

A minimum warrant of 10 years on the equipment and installation will be required.

Option1: 100% Pay as we Go I

Illustrative Incentive Schedule

Capacity Eligible for Incentive	Min: 250 kW	Max: 25 MW
Upfront Incentive($/kW)	N/A	N/A
Contract Term	3-year	Renewable on time
Alt. Clawback provision	Must pay rider for 3 years	Must pay rider for 3 years

Capacity Factor	Bonus Multiplier	Off-Peak ($/MWh)	On-Peak ($/MWh)
<= 50% (Floor guaranteed min.)	-	$20.0	$25.0
50% - 60%	1.05x	$21.0	$26.3
60%-75%	1.10x	$22.0	$27.5
75% - 90%	1.15x	$23.0	$28.8
90% - 100%	1.20x	$24.0	$30.0

Example

Customer John Doe		Cap. Factor	Incentive Eligible
Installs a 2 MW (Net of parasytic load) CHP project.		A weighted average of cap. factors during On-Peak and Off-Peak periods	N/A
On-Peak Cap Factor		58%	The first 50% of the On-Peak production receive $25/MWh, the next 8% receive $26.3/MWh
Off-Peak Cap Factor		79%	The first 50% of the On-Peak production receive $20/MWh, the next 10% receive $21/MWh, the next 15% receive $22/MWh and finally the next 4% receive $23/MWh.

Option 2: Upfront $ + Pay as we Go I

Illustrative Incentive Schedule

Capacity Eligible	Min: 250 kW	Max: 25 MW
Upfront Incentive($/kW)	$300	Min of $7.5M or 50% of Inst. Cost.
Contract Term	6-year	Non-renewable
Alt. Clawback provision	50% of $/kW + interest penalty	If customer backs out after 3-years.

Capacity Factor	Bonus Multiplier	Off-Peak ($/MWh)	On-Peak ($/MWh)
<= 50% (Floor guaranteed min.)	-	$6.7	$8.3
50% - 60%	1.05x	$7.0	$8.8
60%-75%	1.10x	$7.3	$9.2
75% - 90%	1.15x	$7.7	$9.6
90% - 100%	1.20x	$8.0	$10.0

Example

Customer John Doe		Cap. Factor	Incentive Eligible
Installs a 2 MW (Net of parasytic load) CHP project.		N/A	$600,000
On-Peak Cap Factor		58%	The first 50% of the On-Peak production receive $8.3/MWh, the next 8% receive $8.8/MWh.
Off-Peak Cap Factor		79%	The first 50% of the On-Peak production receive $6.7/MWh, the next 10% receive $7.0/MWh, the next 15% receive $7.3/MWh and finally the next 4% receive $7.7/MWh.