COMMONWEALTH OF KENTUCKY

BEFORE THE PUBLIC SERVICE COMMISSION

In the Matter of:

Electronic Annual Cost Recovery Filing	)	
For Demand Side Management By	)	Case No. 2017-00427
Duke Energy Kentucky, Inc.,	)	

DIRECT TESTIMONY OF

TIMOTHY J. DUFF

ON BEHALF OF

DUKE ENERGY KENTUCKY, INC.

April 12, 2018

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I. INTRODUCTION

Q. PLEASE STATE YOUR NAME AND BUSINESS ADDRESS.

A. My name is Timothy J. Duff. My business address is 400 South Tryon Street, Charlotte, North Carolina 28202.

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

A. I am employed by Duke Energy Business Services LLC (DEBS), an affiliate of Duke Energy Kentucky, Inc., (Duke Energy Kentucky, or Company) as General Manager, Customer Solutions Regulatory Strategy & Evaluation. DEBS provides various administrative and other services to Duke Energy Kentucky and other affiliated companies of Duke Energy Corporation (Duke Energy).

Q. PLEASE SUMMARIZE YOUR EDUCATION AND PROFESSIONAL EXPERIENCE.

A. I graduated from Michigan State University with a Bachelor of Arts in Political Economics and a Bachelor of Arts in Business Administration, and received a Master of Business Administration degree from the Stephen M. Ross School of Business at the University of Michigan. I started my career with Ford Motor Company and worked in a variety of roles within the company's financial organization, including Operations Financial Analyst and Budget Rent-A-Car Account Controller. After five years at Ford Motor Company, I started working with Cinergy in 2001, providing business and financial support to plant operating staff. Eighteen months later, I joined Cinergy's Rates Department, where I provided revenue requirement analytics and general rate support for the company's transfer of three generating plants. After my time in the Rates

Department, I spent a short period in the Environmental Strategy Department, and then I joined Cinergy's Regulatory and Legislative Strategy Department. After Cinergy merged with Duke Energy in 2006, I was employed as Managing Director, Federal Regulatory Policy. In this role, I was primarily responsible for developing and advocating Duke Energy's policy positions with the Federal Energy Regulatory Commission. I became General Manager, Energy Efficiency & Smart Grid Policy and Collaboration in 2010, was named General Manager, Retail Customer and Regulatory Strategy in 2011, and assumed my current position of General Manager, Customer Regulatory Strategy and Evaluation in 2013.

Q. PLEASE DESCRIBE YOUR RESPONSIBILITIES AS GENERAL MANAGER, CUSTOMER REGULATORY STRATEGY & ANALYTICS.

A. As General Manager, Customer Solutions Regulatory Strategy & Evaluation, I am responsible for the development of strategies and policies related to energy efficiency (EE) and other retail products and services. I also oversee the analytics functions associated with evaluating and tracking the performance of Duke Energy's retail products and services.

Q. HAVE YOU PREVIOUSLY TESTIFIED BEFORE THE PUBLIC UTILITIES COMMISSION OF KENTUCKY?

A. Yes. I have provided testimony in the Company's application that established its energy efficiency cost recovery mechanism and portfolio of programs in Case No 2012-00085.

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

A. The purpose of my testimony in this proceeding is respond to the Commission's February 14, 2018 Order directing the Company to suspend its demand side management (DSM) programs except for Low Income Services and Neighborhood Programs until the Commission is able to determine that ratepayer benefits exceed ratepayer costs. In doing so, I support the validity, cost-effectiveness, and reasonableness of the Company's EE and DSM programs. I briefly describe the history of these programs; identify the portfolio of programs the Company offers and how both customers and the Company use them. I describe how the Company's cost recovery of its DSM programs through Rider DSM is reasonable and why the Commission should reconsider its directive that the Company essentially cease offering these programs to customers.

II. ENERGY EFFICIENCY PROGRAM

Q. PLEASE BRIEFLY SUMMARIZE THE HISTORY OF DUKE ENERGY KENTUCKY'S DSM PROGRAM AND PORTFOLIO.

A. The Company's offering of DSM programs dates back close to two decades where the Commission approved a Joint application made between the Company (f/k/a Union Light Heat and Power Company,) and multiple stakeholders that included,

among others, the Office of the Kentucky Attorney General (AG), and the Northern Kentucky Citizens Action Commission.[1] Among other things, the Commission's Order approved specific programs, a collaborative process with stakeholders that included customers to consider and develop additional DSM programs and tariffs that enabled the Company to recover tis DSM program and administrative costs, lost revenues and an incentive. This basic structure remains in place today. Throughout the years, the Company has offered many enhancements to its portfolio with the purpose of increasing participation and providing customers new and innovative opportunities to control their consumption and affect their utility bill.

The portfolio of programs in place during the fiscal year ending June 30, 2017 and that is the subject of this proceeding was approved by the Commission's June 29, 2012 Order in Case No. 2012-00085. That Order approved continuation of all programs through December 31, 2016. The Company requested and received approval to continue the approved portfolio beyond December 31, 2016.[2] In Duke Energy Kentucky's 2012 DSM cost recovery Order, Case No. 2012-00495, the Commission ordered that any new program evaluations, program expansions or new programs be filed by August 15th each year. Duke Energy Kentucky has been

[1] *See In the Matter of the Joint Application Pursuant to 1994 House Bill No. 501 For the Approval of Principles of Agreement, Demand Side Management, The Union Light Heat and Power Company, and for Authority for the Union Light Heat and Power Company to Implement Various Tariffs and Receive Incentives Associated the Demand Side Management Programs,* Order, Case No. 95-00312, (Ky. P.S.C. Dec. 1, 1995).

[2] *See* Order, Case No. 2015-00277

filing this amendment filing since 2013[3] to enhance the DSM portfolio and react to market changes and customer needs. This filing has given Duke Energy Kentucky the opportunity to refresh the portfolio on an annual basis.

Q. PLEASE BRIEFLY EXPLAIN HOW THE COMPANY'S RIDER DSM OPERATES.

A. Rider DSM enables the Company to develop and offer a variety of energy efficiency and demand response programs that incentivize and facilitate customers to implement cost-effective measures in a manner that does not penalize the Company or erode its earnings in an unreasonable manner. Such a structure is necessary because under basic tenets of ratemaking, a utility's base rates are designed to enable it to recover its reasonable costs of providing service and an opportunity to earn a reasonable return on its invested capital. The sale of electricity as a charge per kilowatt-hour (kWh) to customers is how the Company is able to recover its costs, earn a reasonable return on its capital invested and fund its operations. This creates what is known as a "through put" incentive for utilities to sell more electricity, not less. Programs such as the Company's Rider DSM help to align the utility's interest in selling more electricity with the customer's desire to use less. The Rider DSM mechanism allows the Company to recover its costs of providing these EE/DSM programs to customers, provide

[3] The Commission's December 19, 2013 Order in Case No. 2013-00313 approved residential Heat Pump Water Heaters, Energy Efficiency Pool Pumps, Single Family and Multi-Family Water Measures, and updated the measures available within the Smart $aver® Prescriptive Program. The Commission's January 28, 2015 Order in Case No. 2014-00280 approved adding additional lighting options to the Smart Saver® Residential Program, offer the My Home Energy Report as an online channel, and approved a new Non-Residential Small Business Energy Saver program. Additional program changes were filed in Case No. 2015-00277. In Case No. 2016-00289 Duke Energy Kentucky received approval to include Power Manager® for Apartments, Power Manager® for Business and additional program changes to existing programs. Pending Case No. 2017-00324 requested additional funding for the Smart $aver Custom program.

some insulation from lost margins due to the reduction in sales of electricity, and provide a small incentive to offer these programs. The load reductions achieved have the benefit of reducing the Company's overall load obligation that in turn, creates the potential to allow the Company to delay its investment in expensive generating resources. These reductions also enable the Company to maximize the potential of its existing generation through potential sales of any excess into the wholesale markets. As Company witness Mr. Verderame explains, the majority of the net proceeds of off-system sales are shared directly with customers through a bill credit enabled by the Profit Sharing Mechanism (Rider PSM).

Q. PLEASE BRIEFLY DESCRIBE DUKE ENERGY KENTUCKY'S CURRENT PORTFOLIO OF DSM PROGRAMS.

A. Duke Energy Kentucky offers its customers multiple regulated EE and DSM related services and products, as well as low-income assistance programs within the Commonwealth of Kentucky. The various programs are vetted through the collaborative process whereby it gets feedback from a wide array of stakeholders before being submitted to the Commission for review and approval. Duke Energy Kentucky recovers its costs and receives compensation for these services pursuant to its Commission-approved DSM tariff riders. The current suite of programs include the following: 1) Residential Smart $aver®; 2) Residential Energy Assessments; 3) Energy Efficiency Education Program for Schools; 4) Low Income Services; 5) The Payment Plus program; 6) Residential Direct Load Control- Power Manager;® 7) My Home Energy Report; 8) Low Income Neighborhood Program; 9) Smart $aver® Prescriptive; 10) Smart $aver® Custom;

11) Smart $aver® Energy Assessments; 12) Small Business Energy Saver; and 13) Power Share®.

The Commission has approved each of these programs and reviews the costs and results of these programs on an annual basis.

Q. PLEASE BRIEFLY DESCRIBE THE RESIDENTIAL SMART$AVER® PROGRAM.

A. The purpose of the Residential Smart $aver® Program is to offer customers a variety of energy conservation measures designed to increase energy efficiency in their homes. The program utilizes a network of contractors to encourage the installation of high efficiency equipment and the implementation of energy efficient home improvements. Equipment and services to be incentivized include: 1) installation of high efficiency air conditioning (AC) and heat pump (HP) systems; 2) performance of AC and HP tune-up maintenance services; 3) implementation of attic insulation and air sealing services; 4) implementation of duct sealing and insulation services; and 5) installation of efficient heat pump water heaters. Additional measures in this program include high efficiency lighting including property manager lighting, high efficiency water measures for single and multi-family residences, and pool pumps.

Q. PLEASE BRIEFLY DESCRIBE THE RESIDENTIAL ENERGY ASSESSMENTS PROGRAM.

A. This program is offered to Duke Energy Kentucky residential customers that own a single family home with at least four months usage history and have an electric water heater and/or electric heat, or central air. The primary goal is to

empower customers so they can better manage energy usage and cost. Duke Energy Kentucky partners with several key vendors to administer the program in which an energy specialist completes a 60 to 90 minute walk through assessment of the home and analyzes energy usage to identify energy savings opportunities. The customer receives an audit report that focuses on the building envelope improvements as well as low-cost and no-cost improvements to save energy. At the time of the home audit, the customer also receives a free efficiency kit containing a variety of energy saving measures such as energy efficient lighting, a low flow showerhead, low flow faucet aerators, outlet/switch gaskets and weather stripping. The auditors will install these measures, if approved by the customer, so the customer can begin saving immediately, and to help insure proper installation and use. The installation of additional high efficiency lighting options is also available.

Q. PLEASE BRIEFLY DESCRIBE THE ENERGY EFFICIENCY EDUCATION PROGRAM FOR SCHOOLS PROGRAM.

A. The Energy Efficiency Education Program for Schools offers two educational interactions: 1) an in-depth classroom curriculum through the National Energy Education Development (NEED) project; and 2) a live theatrical production by The National Theatre for Children (NTC).

The NEED project provides educators with an engaging and exciting energy curriculum for students in classrooms. The NEED project is designed to teach energy concepts of force, motion, light, sound, heat, electricity, magnetism, energy transformations, and energy efficiency. Energy curriculum, based upon

state standards, and hands-on kits, are provided to teachers for use in their classrooms. Energy workshops are designed to provide educators (teaching grades K-12) with the content knowledge and process skills to return to their classrooms and communities, energize and educate their students, provide outreach to families and conduct energy education programs that assist families in implementing behavioral changes that reduce energy consumption. Teachers can utilize the classroom energy kits and curriculum over many years. In addition, Duke Energy Home Energy Efficiency Kits are delivered to the classrooms to teach students and families how to install energy efficiency measures in their homes and to record energy savings.

Kentucky NEED manages the overall implementation for the Duke Energy Kentucky program and works with individual schools, teachers, and students to gain the maximum impact for the program. Kentucky NEED has received numerous accolades for its support of energy efficiency and conservation in local schools, for its support of ENERGY STAR's Change the World Campaign, and for the integration of a student/family approach to conservation education. To support, recognize and encourage student energy leadership, Kentucky NEED hosts the annual Kentucky NEED Youth Awards for Energy Achievement in Washington, D.C., honoring teams of students who have successfully planned and facilitated energy projects in their schools and communities. NEED held two teacher workshops in the 2016/2017 school year with 46 teachers representing 31 schools in the September training and 14 teachers representing 8 schools participating in the March training.

Q. PLEASE BRIEFLY DESCRIBE THE LOW INCOME SERVICES PROGRAM.

A. The Weatherization Program portion of Low Income Services is designed to help the Company's income-qualified customers reduce their energy consumption and lower their energy cost. This program specifically focuses on LIHEAP (Low Income Home Energy Assistance Program) customers that meet the income qualification level (*i.e.*, income below 150 percent of the federal poverty level). This program uses the LIHEAP intake process as well as other community outreach initiatives to improve participation. The program provides direct installation of weatherization and energy-efficiency measures and educates Duke Energy Kentucky's income-qualified customers on their energy usage and other opportunities that can help reduce energy consumption and lower energy costs.

Q. PLEASE BRIEFLY DESCRIBE THE PAYMENT PLUS PROGRAM.

A. The Payment Plus portion of Low Income Services program is designed to impact participants' behavior (*e.g.*, encourages utility bill payment and reducing arrearages) and to generate energy conservation impacts. The program includes both the early participants and new participants each year.

The program is made up of three components: 1) Energy Education & Budget Counseling to help customers understand how to control their energy usage and how to manage their household bills using a combined education/counseling approach; 2) Weatherization Services to increase the energy efficiency in customers' homes (participants are required to have their homes weatherized as part of the normal Residential Conservation and Energy Education

[low-income weatherization] program unless weatherized in past program years); and 3) Bill Assistance to provide an incentive for these customers to participate in the education and weatherization; and to help them get control of their bills. Payment assistance credits are provided to each customer once they complete each aspect of the program. The credits are: $200 for participating in the EE counseling, $150 for participating in the budget counseling, and $150 for participating in the Residential Conservation and Energy Education program (weatherization services). If all the requirements are completed, a household could receive up to a total of $500 towards their arrearage. This allows approximately 200 homes to participate per year. Some customers do not complete all three steps or may have already had weatherization services completed prior to the program.

Q. PLEASE BRIEFLY DESCRIBE THE RESIDENTIAL DIRECT LOAD CONTROL- POWER MANAGER® PROGRAM.

A. The purpose of the Power Manager® program is to reduce demand by controlling residential air conditioning usage during periods of peak demand, high wholesale price conditions and/or generation emergency conditions during the summer months. It is available to residential customers with central air conditioning. Duke Energy Kentucky attaches a load control device to the outdoor unit of a customer's air conditioner. This enables Duke Energy Kentucky to cycle the customer's air conditioner off and on under appropriate conditions.

Customers selecting the option that moderately cycles their air conditioner, receive a $25 credit at installation. Customers selecting the longer

cycling option, receive a $35 credit at installation. Customers also receive annual credits during the months of May-September depending on the program.

Q. PLEASE BRIEFLY DESCRIBE THE MY HOME ENERGY REPORT PROGRAM.

A. The My Home Energy Report (MyHER Report) compares household electric usage to similar, neighboring homes, and provides recommendations and actionable tips to lower energy consumption. The report also informs a customer of the other energy efficiency programs available if applicable. These normative comparisons are intended to induce customers to adopt more efficient energy consumption behavior. The MyHER Report will be delivered in printed or online form to targeted customers with desirable characteristics who are likely to respond to the information. The printed reports are distributed up to 12 times per year; however, delivery may be interrupted during the off-peak energy usage months in the fall and spring. Currently to qualify to receive the MyHER Report, customers must be living in a single metered, single family home with 13 months usage history.

The MyHER program is an opt-out program and the Company provides information on every report as to how a customer may request to stop receiving the reports.

Q. PLEASE BRIEFLY DESCRIBE THE LOW INCOME NEIGHBORHOOD PROGRAM.

A. The Duke Energy Kentucky Residential Neighborhood Program takes a non-traditional approach to serving income-qualified areas of the Duke Energy Kentucky service territory by directly installing energy efficiency measures in customer

homes. The program engages targeted customers with personal interaction in a familiar setting while ultimately reducing energy consumption by installing energy efficient measures and educating customers on ways to manage and lower their energy bills. Examples of direct installed measures include energy efficient bulbs, water heater and pipe wrap, low flow shower heads/faucet aerators, window and door air sealing and a year supply of HVAC filter replacements. Targeted low-income neighborhoods qualify for the program if at least 50 percent of the households are at or below 200 percent of the federal poverty guidelines. Duke Energy Kentucky analyzes census and internal data to select and prioritize neighborhoods that have the greatest need and propensity to participate. While the goal is to serve neighborhoods where the majority of residents are low income, the program is available to all Duke Energy Kentucky customers within the selected boundary. This program is available to both homeowners and renters occupying single family and multi-family dwellings in the target neighborhoods that have electric service provided by Duke Energy Kentucky.

Q. PLEASE BRIEFLY DESCRIBE THE SMART $AVER® PRESCRIPTIVE PROGRAM.

A. The Smart $aver® Non-residential Prescriptive Incentive Program provides incentives to commercial and industrial consumers for installation of high efficiency equipment in applications involving new construction, retrofit, and replacement of failed equipment. The program also uses incentives to encourage maintenance of existing equipment in order to reduce energy usage. Incentives are

provided based on Duke Energy Kentucky's cost effectiveness modeling to assure cost effectiveness over the life of the measure.

Q. PLEASE BRIEFLY DESCRIBE THE SMART $AVER® CUSTOM PROGRAM.

A. The purpose of this program is to encourage the installation of high efficiency equipment in new and existing nonresidential establishments. The program provides incentive payments to offset a portion of the higher cost of energy efficient equipment. Duke Energy Kentucky contracts with a third party to perform technical review of applications as part of implementation of this program. This program is jointly implemented with the Duke Energy Indiana, Duke Energy Ohio, and Duke Energy Carolinas territories to reduce administrative costs and leverage promotion.

Q. PLEASE BRIEFLY DESCRIBE THE SMART $AVER® ENERGY ASSESSMENTS PROGRAM.

A. The purpose of this program is to assist customers with the evaluation of energy usage within a specific building(s) and to provide recommendations for energy savings projects. The program may provide up to a 50 percent subsidy for an energy efficiency audit completed in partnership with Duke Energy contracted professional engineering organization or a third-party engineering firm of the customer's choice. This program is jointly implemented within the Duke Energy Indiana, Duke Energy Ohio, and Duke Energy Carolinas territories to reduce administrative costs and leverage resources.

Q. PLEASE BRIEFLY DESCRIBE THE SMALL BUSINESS ENERGY SAVER (SBES) PROGRAM.

A. The purpose of Duke Energy's Small Business Energy Saver program (SBES Program) is to reduce energy usage through the direct installation of energy efficiency measures within qualifying small non-residential Duke Energy Kentucky customer facilities. All aspects of the SBES Program are administered by a single Company-authorized vendor. The SBES Program measures address major end-uses in lighting, refrigeration, and HVAC applications.

The SBES Program participants receive a free, no-obligation energy assessment of their facility followed by a recommendation of energy efficiency measures to be installed in their facility along with the projected energy savings, costs of all materials and installation, and up-front incentive amount from Duke Energy Kentucky. Upon receiving the results of the energy assessment, if the customer decides to move forward with the proposed energy efficiency project, the customer makes the final determination of which measures will be installed. The energy efficiency measure installation is then scheduled at a convenient time for the customer and the measures are installed by electrical subcontractors of the Duke Energy-authorized vendor.

Q. PLEASE BRIEFLY DESCRIBE THE POWERSHARE® PROGRAM.

A. PowerShare® is the brand name given to Duke Energy Kentucky's Peak Load Management Program (Rider PLM, Peak Load Management Program KY P.S.C. Electric No. 2, Sheet No. 77). Rider PLM was approved pursuant as part of the settlement agreement in Case No. 2006-00172. In the Commission's Order in

Case No. 2006-00426, approval was given to include the PowerShare® program within the DSM programs. The PLM program is voluntary and offers customers the opportunity to reduce their electric costs by managing their electric usage during the Company's peak load periods. Customers and the Company will enter into a service agreement under Rider PLM, specifying the terms and conditions under which the customer agrees to reduce usage. There are two product options offered for PowerShare® - CallOption® and QuoteOption®:

- CallOption®:

A customer served under a CallOption® product agrees, upon notification by the Company, to reduce its demand by a contracted amount. Each time the Company exercises its option under the agreement, the Company will provide the customer a credit for the energy reduced. Additionally, emergency events may be implemented due to reliability concerns. Participants are required to curtail during emergency events. In addition to the energy credit, customers on the CallOption® will receive an option premium credit. For the 2018-19 Delivery Year, customers had three CallOption® participation program choices: "Limited Summer", "Summer Only" and "Annual". Limited Summer has rules that reflect the PJM Limited Demand Response Program, Summer Only rules are similar to Base Capacity and Annual is designed to reflect Capacity Performance.

- QuoteOption®:

Under the QuoteOption® products, the customer and the Company agree that when the average wholesale market price for energy during the notification period is greater than a pre-determined strike price, the Company may notify the

customer of a QuoteOption® event and provide a price quote to the customer for each event hour. The customer will decide whether to reduce demand during the event period. If they decide to do so, the customer will notify the Company and provide an estimate of the customer's projected load reduction. Each time the Company exercises the option, the Company will provide the participating customer who reduces load an energy credit. There is no option premium for the QuoteOption® product since customer load reductions are voluntary. Only customers able to provide a minimum of 100 kW load response qualify for QuoteOption®.

Q. PLEASE EXPLAIN HOW THESE PROGRAMS ARE BENEFICIAL TO BOTH CUSTOMERS AND THE COMPANY.

A. These programs provide numerous benefits to both customers and the Company. First, for customers, these programs offer an opportunity to reduce energy consumption and control their monthly electric and gas bills. Many of these programs also provide incentives to customers that are used to either directly lower their bill or to help fund the installation of cost-effective measures that will also lower their consumption once implemented. As I previously mentioned, to the extent these EE/DSM programs effectively reduce the Company's load obligation, any excess existing generation (energy and capacity) can potentially be sold into the wholesale markets, the net proceeds of which flow back to customers through the Company's Rider PSM.

The DSM programs also have a direct impact on the Company's participation in PJM Interconnection LLC (PJM). As more fully explained by Mr.

Verderame, the Company has specific obligations with respect to serving customer load as a member of PJM. The existence of these programs, and particularly the various load control programs, enable the Company to meet these requirements in a cost-effective manner without having to invest in more generating resources by direct investment or through a bilateral purchase.

Q. PLEASE FURTHER EXPLAIN HOW THE COMPANY CAN USE THESE EE/DSM PROGRAMS TO MEET ITS PJM REQUIREMENTS.

A. Based on the program design of its different programs and the on-going dynamic nature of PJM's capacity market, Duke Energy Kentucky relies upon a number of different strategies in addition to its owned generation resources, to meet its fixed resource requirement (FRR) capacity plan. The Company's EE/DSM programs further provide customers an opportunity to participate in PJM's EE/DSM markets through a Company tariff in a manner consistent with the Commission's Order approving the Company's joining PJM in Case No. 2010-00203.[4] Mr. Verderame further explains the Company's FRR plan and compliance strategies in his testimony and how the Company relies upon its EE/DSM programs as part of that compliance strategy both now and in the future.

For example, in the current June 2018 through May 2019 planning year, the Company submitted about 90% of the Power Manager® program peak capability to PJM for the final 2018-2019 FRR capacity plan. The contracted

[4] *In the Matter of the Application of Duke Energy Kentucky, Inc., for Approval to Transfer Functional Control of its Transmission Assets from the Midwest Independent Transmission System Operator to the PJM Interconnection Regional Transmission Organization and Request for Expedited Treatment,* Order, Case No. 2010-00203 (Ky. P.S.C. Dec. 20, 2010); "No customer should be allowed to participate directly or through a third party in any PJM demand-response program until that customer has entered into a special contract with Duke Kentucky which has been filed with, and approved by, the Commission, *or until Duke Energy Kentucky has an approved tariff authorizing customer participation." Emphasis added.*

Power Manger® capacity has the capability to meet the requirements of PJM's Limited Demand Response program (maximum 10 emergency events, of a maximum of 6-hours in length, summer weekdays between noon and 8 pm).

Looking forward, during the 2019-2020 Delivery Year, PJM's summer program will be classified as "Base Capacity Demand Response." The Company's initial FRR plans for this future Delivery Year, based upon historic participation levels, will continue to include the anticipated Power Manager® capacity that will be secured by contract to meet the Company's FRR capacity obligation. Since the Base Capacity Demand Response events can be called by PJM for up to 10 hours in length and can be called on weekends and holidays, the Company is planning on rotating participant groups (in an effort to not fatigue customers during a long event), so only about 40% of the program capability is being submitted as part of the FRR for that year. Starting in the 2020-2021 Delivery Year, PJM requires all capacity in the FRR Plan to meet the "Capacity Performance" standard, which requires annual capability. The Company will need to either modify the structure of Power Manager® to include a winter component or pair it with some other program/resource in the Company's EE/DSM portfolio that together, can meet Winter demand concerns and qualify as an eligible Capacity Performance resource.

Similarly, the Company's Power-Share® CallOption® program is also included in the FRR Capacity plan for the 2018-2019 Delivery Year. Approximately 85% of the CallOption® capability is being relied upon in the Company's 2018-2019 FRR Plan. A similar percentage is being used for 2019-

2020 Delivery Year, while reflecting a reduction in over capability due to the removal of "Limited DR" as a program option and recognizing that some Commercial/Industrial customers won't be willing to sign up for a program with maximum number of events. Starting in the 2020-2021 Delivery Year, only agreements that meet the terms for Capacity Performance will be used in the FRR commitment.

Q. DOES DUKE ENERGY KENTUCKY SIGN MULTI-YEAR POWERSHARE® OR POWER MANAGER® PROGRAM CONTRACTS WITH CUSTOMERS?

A. No. The Company enters into these contracts on an annual basis, for the upcoming Delivery Year, in advance of the submittal of the final FRR Plan. The Company bases future FRR Plan capacity estimates based upon prior customer participation. It is important to note that if the Company were to terminate the Power Manager®, it would likely incur costs in excess of $1 million to remove the control devices from customers' homes, while the cost to maintain the annual resource associated with the program is less $300 thousand per year.

Q. DO CUSTOMERS ACTUALLY PARTICIPATE IN AND RELY UPON THE COMPANY'S EE/DSM PROGRAMS?

A. Yes, Duke Energy Kentucky customers do participate in and rely on the Company's EE/DSM programs to undertake energy efficient behavior and make investments in energy efficient measures. In fact, the Company has actually seen customer participation increase over the past few years along with the measured and verified kWh savings achieved through the programs also increasing

substantially. Beyond the fact that the Company continues to see increased customer participation, the Company's independent Evaluation, Measurement and Verification (EM&V) determines free ridership, or the percentage of the energy efficiency savings that would have been achieved even if the Company had not offered the incentives through its programs.

Q. WHAT IS THE AGGREGATE FREE RIDERSHIP FOR THE CURRENT PORTFOLIO AND WHAT DOES THAT INDICATE?

A. The aggregate free ridership across all programs in the portfolio during its most recent vintage (2017-2018) was 13 percent. The fact that 87 percent of the impacts were found through the EM&V process to have occurred directly because of the Company's program rather than other factors is clear indication that these programs are not only relied upon by customers but are justifiable.

Q. HOW DOES DUKE ENERGY KENTUCKY MEASURE THE COST-EFFECTIVENESS OF ITS DSM PROGRAMS?

A. Duke Energy Kentucky evaluates the cost-effectiveness of energy efficiency programs using the four tests specified in the California Standard Practice Manual (SPM). These tests are recognized throughout the industry and have historically been accepted by the Kentucky Public Service Commission in the Company's annual EE/DSM filings. The tests utilize estimates of the net present value of the financial stream of costs versus benefits, *i.e.*, the cost to implement the measure is valued against the savings or avoided costs. Put another way, the stream of costs to implement the measures are valued against the stream of savings or avoided costs over the life of the measure or program.

Q. PLEASE DESCRIBE THESE COST EFFECTIVENESS TESTS.

A. The cost-effectiveness tests utilized are the Participant Cost Test (PCT), the Utility Cost Test (UCT), the Total Resource Cost (TRC), and the Ratepayer Impact Measure (RIM) Test.

- The PCT is designed evaluate cost effectiveness from the perspective of the customer participating in the program. It compares the benefits to the participant through bill savings and incentives from the utility, relative to the costs to the participant for implementing the energy efficiency measure. The costs a customer may incur can include incremental equipment and installation costs, as well as increased annual operating cost, if applicable.
- The UCT is designed to compare a utility's investment in EE/DSM versus traditional supply side investment as it compares utility benefits (avoided energy, transmission and distribution capacity and generation capacity related costs) to utility costs incurred to implement the program such as marketing, customer incentives, and implementation costs, and does not consider other benefits such as participant savings or societal impacts.
- The TRC Test compares the total benefits to the utility and to participants relative to the costs to the utility to implement the program plus the incremental costs to the participant. The benefits to the utility are the same as those computed under the UCT. The

benefits to the participant are the same as those computed under the PCT; however, customer incentives are considered a pass-through benefit to customers. As such, incentives or rebates to the customer are not included in the TRC.

- The RIM Test is a more theoretical test designed to indicate if rates are expected to increase or decrease over the long run because of implementing the program. It compares the benefits to the utility, the same benefits as included in the UCT, to the costs required to implement a program including lost revenues.

While the Company has traditionally viewed the UCT as the optimal test to evaluate the operation of its portfolio of programs versus investing in more tradition supply-side investments, Duke Energy Kentucky believes that evaluating the programs through the lens of multiple tests helps to ensure the development of a reasonable set of EE/DSM programs. It should also be noted that none of the tests described above include external benefits to participants and non-participants that can also offset the costs of the programs.

Q. ARE THE COMPANY'S EE/DSM PROGRAMS COST EFFECTIVE?

A. Yes, the programs in the Company's portfolio, as approved by the Commission in Case No. 2016-00382, that were offered to its customers, prior to the Commission's February 14, 2018 Order had an overall UCT of well above 3.0, as well as a scores greater than 1.0 on the other three cost effectiveness tests.

Q. IN THE COMPANY'S RESPONSE TO ITEMS 1 AND 2 OF STAFF's SECOND INFORMATION REQUEST IN THIS PROCEEDING, THE

COMPANY INDICATED THAT ITS ENERGY AND CAPACITY COST EFFECTIVENESS INPUTS ARE BASED ON 2011 DATA, PLEASE EXPLAIN WHY YOU STILL BELIEVE THE COMPANY'S DSM PROGRAMS REMAIN COST EFFECTIVE?

A. The Company response to Items 1 and 2 of the Staff's Second Information Request was based on the cost effectiveness analysis of the Programs being offered July 2016 through June 2017, as approved by Commission in Case No. 2016-00382 on March 27, 2017. The Company filed updated cost effectiveness scores with its application in this case. The Company believes that it response is appropriate because the programs that were being offered at the time on the Commission's February 14, 2018 Order suspending them were approved based on the avoided cost analysis that utilized escalated 2011 avoided costs.

Q. HAS THE COMPANY UPDATED ITS COST EFFECTIVENESS CALACULATIONS FOR ITS PROGRAMS IN THIS PROCEEDING?

A. Yes, while the Appendix A that was shown in the Company's Application in Case No. 2017-00427 was based on avoided cost inputs from 2011, in its application the Company had updated the avoided costs inputs that were used to evaluate the projected July 2018 thru June 2019 portfolio to reflect escalated 2016 avoided costs.

Q. AFTER UPDATNG THE AVOIDED COST INPUTS UNDERLYING THE PROJECTED JULY 2018 THRU JUNE 2019 PROGRAMS AS INCLUDED IN THE COMPANY APPLICATION IN CASE NO 2017-00427, ARE THE PROGRAMS COST EFFECTIVE?

A. Yes, As shown on Page 1 of Attachment TJD-1, the overall portfolio UCT is nearly 2.0.

Q. HAS THE COMPANY CALCULATED THE COST EFFECTIVENESS OF ITS DSM PROGRAMS EXCLUDING AVOIDED CAPACITY COSTS??

A. Yes. Despite the fact that Duke Energy Kentucky believes that it has appropriately analyzed the cost effectiveness of its programs by considering the avoided capacity values in the analysis, it has also performed the analysis excluding the avoided capacity costs.

Q. DO THESE PROGRAMS REMAIN COST EFFECTIVE EXCLUSIVE OF AVOIDED CAPACITY?

A. Yes, as indicated on Page 17, of the Company's March 2, 2018 Petition for Rehearing in Case No 2017-00427, even if the Company removed the avoided capacity values from the additional cost effectiveness analysis performed on its portfolio of programs reflected in Appendix A (programs offered July 2016-June 2017), the portfolio would remain cost effective with an overall UCT of 2.8. The Company also performed a similar cost effectiveness analysis of the projected July 2018 thru June 2019 portfolio excluding avoided capacity costs. After performing this analysis the portfolio is cost effective with an overall UCT of over 1.4, as shown Attachment TJD-1 Page 2.

Q. DO YOU BELIEVE THAT THE COMMISSION SHOULD ALLOW THE COMPANY TO CONTINUE ITS EXISTING LEVEL OF EE/DSM PROGRAMS FOR CUSTOMERS?

A. Yes, Duke Energy Kentucky believes that its cost effective portfolio of programs should continue to be offered. The programs enable customers to become educated, engaged and empowered to be more energy efficient and take control of their energy bills. Additionally, the offering of the portfolio of programs allows the Company to satisfy capacity supply obligations associated with its membership in PJM.

Q. DOES THE COMPANY TAKE PROACTIVE STEPS TO MONTIOR ITS DSM PROGRAM COSTS AND TO MANAGE ITS BUDGETS?

A. Yes. The Company does proactively monitor its EE/DSM programs and provides regular status updates to the Commission. The Company believes that customer interest and natural demand to participate in cost- effective EE/DSM programs should not be artificially constrained by an estimated budget, particularly when these programs are available and paid for by all customers, the Company has long been, and continues to be, strongly focused on managing the overall costs of its programs. The Company reviews program costs on a monthly basis, and continually looks for opportunities to reduce costs. These opportunities include leveraging efficiencies that can be gained through program management between multiple jurisdictions to enable better unit pricing from vendors. In addition, consistent with the Commission's Order in Case No. 2015-00368, Duke Energy Kentucky informs the Commission when a program reaches 95 percent of its forecasted budget for the fiscal year. The Company also informs the Commission if a program will exceed its budget by 25 percent during the fiscal year.

Q. GIVEN THE COMMISSION'S CONCERN WITH THE COSTS OF DSM PROGRGAMS IN RELATION TO THE BENEFITS TO CUSTOMERS, IS THE COMPANY WILLING TO IMPLEMENT ANY FURTHER ACTION TO CONTINUE TO MANAGE ITS COSTS OF EE/DSM PROGRAMS?

A. Yes. While the Company is hesitant to implement actions that would stifle customer participation in cost effective EE/DSM programs that deliver more system benefits than they cost, Duke Energy Kentucky is willing to implement changes to better manage EE/DSM costs. One potential modification the Company could employ in order to gain greater transparency into customer participation levels and costs would be a reservation system. Particularly, with respect to non-residential customers, the Company could employ a system whereby customers must essentially reserve a spot in a queue to be eligible to receive an incentive thru a program during a fiscal year. If a program was exceeding its budget in a fiscal year, the Company could, if directed to so by the Commission, then use this queue to potentially defer or carry over customer incentives from one fiscal year into the next in order to assist in managing the annual costs recovered through the rider. By employing this type of system, the Company will be able to forecast excess program spending in a more timely manner and manage customer expectations regarding their ability to receive an incentive should the Commission decide that spending in excess of the original budget needs to be constrained.

III. CONCLUSION

Q. DOES THIS CONCLUDE YOUR TESTIMONY?

A. Yes, it does.

VERIFICATION

STATE OF NORTH CAROLINA)
) **SS:**
COUNTY OF MECKLENBURG)

The undersigned, Timothy J. Duff, General Manager, Customer Solutions Regulatory Strategy & Evaluation, being duly sworn, deposes and says that he has personal knowledge of the matters set forth in the foregoing testimony and that it is true and correct to the best of his knowledge, information and belief.

Timothy J. Duff, Affiant

Subscribed and sworn to before me by Timothy J. Duff on this 10 day of April, 2018.

NOTARY PUBLIC

My Commission Expires: August 31, 2022

Appendix A – Based on Updated Avoided Costs
Cost Effectiveness Test Results of Portfolio (July 2018-June 2019)

Program Name	UCT	TRC	RIM	PCT
Residential Programs				
Appliance Recycling Program				
Energy Efficiency Education Program for Schools	1.13	1.38	0.60	
Low Income Neighborhood	0.47	1.39	0.35	
Low Income Services	0.31	1.49	0.25	
My Home Energy Report	1.40	1.40	0.68	
Residential Energy Assessments	1.37	1.47	0.65	
Residential Smart $aver®	1.53	1.34	0.64	3.65
Power Manager®	2.78	4.23	2.78	
Power Manager® for Apartments				
Total	**1.41**	**1.67**	**0.75**	**5.28**
Non-Residential Programs				
Power Manager® for Business	1.10	1.34	0.83	
PowerShare®	2.06	6.09	2.06	
Small Business Energy Saver	2.32	0.99	0.86	2.06
Smart $aver® Non-Residential Performance Incentive Program	3.34	1.23	0.86	2.19
Smart $aver® Custom	2.57	0.69	0.79	1.27
Smart $aver® Prescriptive - Energy Star Food Service Products	3.84	1.84	0.92	3.73
Smart $aver® Prescriptive - HVAC	3.04	1.52	1.26	1.66
Smart $aver® Prescriptive - Lighting	3.28	0.99	0.96	1.46
Smart $aver® Prescriptive - Motors/Pumps/VFD	0.00	0.00	0.00	3.24
Smart $aver® Prescriptive - Process Equipment	0.00	0.00	0.00	4.10
Smart $aver® Prescriptive - IT	0.00	0.00	0.00	5.70
Total	**2.61**	**1.11**	**0.99**	**1.63**
Overall Portfolio Total	**1.97**	**1.28**	**0.88**	**2.28**

Appendix A – Based on Updated Avoided Costs (No Avoided Capacity)
Cost Effectiveness Test Results of Portfolio (July 2018-June 2019)

Program Name	UCT	TRC	RIM	PCT
Residential Programs				
Appliance Recycling Program				
Energy Efficiency Education Program for Schools	0.85	1.04	0.45	
Low Income Neighborhood	0.34	1.02	0.26	
Low Income Services	0.24	1.15	0.19	
My Home Energy Report	1.00	1.00	0.49	
Residential Energy Assessments	1.10	1.19	0.52	
Residential Smart $aver®	1.29	1.13	0.54	3.65
Power Manager®	1.15	1.75	1.15	
Power Manager® for Apartments				
Total	**0.99**	**1.17**	**0.52**	**5.28**
Non-Residential Programs				
Power Manager® for Business	0.62	0.75	0.47	
PowerShare®	0.85	2.52	0.85	
Small Business Energy Saver	1.88	0.80	0.69	2.06
Smart $aver® Non-Residential Performance Incentive Program	2.81	1.03	0.72	2.19
Smart $aver® Custom	2.16	0.58	0.67	1.27
Smart $aver® Prescriptive - Energy Star Food Service Products	3.25	1.56	0.78	3.73
Smart $aver® Prescriptive - HVAC	1.97	0.98	0.81	1.66
Smart $aver® Prescriptive - Lighting	2.61	0.78	0.76	1.46
Smart $aver® Prescriptive - Motors/Pumps/VFD	0.00	0.00	0.00	3.24
Smart $aver® Prescriptive - Process Equipment	0.00	0.00	0.00	4.10
Smart $aver® Prescriptive - IT	0.00	0.00	0.00	5.70
Total	**1.92**	**0.82**	**0.73**	**1.63**
Overall Portfolio Total	**1.42**	**0.92**	**0.64**	**2.28**

COMMONWEALTH OF KENTUCKY

BEFORE THE PUBLIC SERVICE COMMISSION

In the Matter of:

Electronic Annual Cost Recovery Filing	)	
For Demand Side Management By	)	Case No. 2017-00427
Duke Energy Kentucky, Inc.,	)	

DIRECT TESTIMONY OF

JOHN A. VERDERAME

ON BEHALF OF

DUKE ENERGY KENTUCKY, INC.

April 12, 2018

TABLE OF CONTENTS

I. INTRODUCTION AND PURPOSE

Q. STATE YOUR NAME AND BUSINESS ADDRESS.

A. My name is John A. Verderame, and my business address is 526 S. South Church Street, Charlotte, North Carolina 28202.

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

A. I am employed by Duke Energy Progress, Inc. (Duke Energy Progress) as Managing Director, Power Trading and Dispatch. Duke Energy Progress is the utility formerly known as Progress Energy Inc., (Progress Energy) located in North and South Carolina. As part of the merger integration process, Duke Energy Progress now provides various administrative and other services to the regulated affiliated companies within Duke Energy Corporation (Duke Energy Corp.), including Duke Energy Kentucky, Inc., (Duke Energy Kentucky or the Company).

Q. PLEASE DESCRIBE BRIEFLY YOUR EDUCATION AND PROFESSIONAL EXPERIENCE.

A. I received a Bachelor of Arts degree in Economics from the University of Rochester in 1983, and a Master's in Business Administration in Finance from Rutgers University in 1985. I have worked in the energy industry for 17 years. Prior to that, from 1986 to 2001, I was a Vice President in the United States (US) Government Bond Trading Groups at the Chase Manhattan Bank and Cantor Fitzgerald. My responsibilities as a US Government Securities Trader included acting as the Firm's market maker in US Government Treasury securities. I joined Progress Energy, in 2001, as a Real-Time Energy Trader. My responsibilities as a

Real-Time Energy Trader included managing the real-time energy position of the Progress Energy regulated utilities. In 2005, I was promoted to Manager of the Power Trading group. My role as manager included responsibility for the short-term capacity and energy position of the Progress Energy regulated utilities in the Carolinas and Florida.

In 2012, upon consummation of the merger between Duke Energy Corp. and Progress Energy, Progress Energy became Duke Energy Progress and I was promoted to my current position.

Q. HAVE YOU EVER TESTIFIED BEFORE THE KENTUCKY PUBLIC SERVICE COMMISSION?

A. Yes. I have previously testified in the Company's Fuel Adjustment Clause (FAC) proceedings and most recently, in Case No. 2017-00321, regarding the Company's application to establish new base electric rates. I have also testified in other cases that have involved the Company's participation in energy and capacity markets.

Q. PLEASE SUMMARIZE YOUR DUTIES AS MANAGING DIRECTOR, POWER TRADING AND DISPATCH.

A. As Managing Director, Power Trading and Dispatch of Duke Energy Progress, I am responsible for Power Trading and Generation Dispatch on behalf of Duke Energy's regulated utilities in the Carolinas, Florida, Indiana, Ohio, and Kentucky. I am primarily responsible for Duke Energy Kentucky's generation dispatch, unit commitment, 24-hour real-time operations, and plant communications related to short-term generating maintenance planning. I lead the

team responsible for managing the Company's capacity position with respect to meeting its Fixed Resource Requirement (FRR) obligation as a member of PJM Interconnection, L.L.C. (PJM), for the submission of the Company's supply offers and demand bids in PJM's day-ahead and real-time electric energy (collectively Energy Markets) and ancillary services markets (ASM), as well as managing the Company's short-term and long-term supply position to ensure that the Company has adequate economic resources committed to serve its retail customers' electricity needs. In that respect, my teams are also responsible for any financial hedging done to mitigate exposure to short-term energy prices and congestion risks.

Q. WHAT IS THE PURPOSE OF YOUR DIRECT TESTIMONY?

A. The purpose of my testimony is to support the Company's desire to continue offering cost-effective energy efficiency (EE) and demand side management (DSM) programs to its customers, and specifically to describe how these programs are relied upon by the Company to meet its load obligations in PJM. In doing so, I provide a brief overview of the Company's generating resources to meet its customer load obligations and provide safe, reliable and adequate service. I then briefly describe Duke Energy Kentucky's resource planning process that is used to ensure it continues to meet its Kentucky customers' load requirements. I then discuss the Company's participation in PJM as it pertains to the capacity markets and discuss the customer benefits that the Company's PJM membership provides. I then describe how the Company must meet its load requirement,

including reserves as required by PJM and how energy efficiency and demand response play a key role in the Company's ability to meet these obligations.

II. OVERVIEW OF DUKE ENERGY'S CURRENT GENERATING RESOURCES

Q. PLEASE PROVIDE A BRIEF OVERVIEW OF HOW DUKE ENERGY KENTUCKY MEETS ITS KENTUCKY LOAD OBLIGATIONS.

A. Duke Energy Kentucky currently owns and operates approximately 1,062 net installed megawatts (MW) of generating capacity, provided by two assets.

Base load requirements are met by the East Bend Unit 2 Generating Station (East Bend). East Bend is a 648 megawatt (MW) (nameplate rating) 600 megawatt (net rating) coal-fired base load unit located along the Ohio River in Boone County, Kentucky. East Bend was commissioned in 1981 and the Company now owns 100 percent of the station, having completed the purchase of the Dayton Power and Light Company's 31 percent interest in the station in 2014.

The Company's peaking requirements are met with the Woodsdale Generating Station (Woodsdale). Woodsdale is a six-unit natural gas-fired combustion turbine (CT) with approximately 462 MW (net summer rating) located in Trenton, Ohio.

In addition, the Company recently completed construction of two small solar facilities representing a total of 6.8 MWs of capacity that went into service in late 2017.

These assets are dispatched into PJM, which maintains functional control of the transmission system within its footprint including the Duke Energy Ohio/Kentucky system.

Q. PLEASE EXPLAIN THE TERMS "NAMEPLATE" AND "NET RATING" AND WHY THEY ARE DIFFERENT.

A. The nameplate ratings, or installed capacity ratings, are the ratings provided by the manufacturer of the generating equipment and these ratings are actually engraved on a nameplate that is affixed to the equipment. This number represents the total number of MWs that are possible to be generated from the station.

Conversely, the net ratings represent the net amount of power that can be dispatched from the plants after some portion of the gross power output is used to power the plant machinery.

The two terms have different uses and meanings. The nameplate rating is typically used when discussing long-term resource planning and is useful for analysis of determining the size of a generator that must be constructed or acquired to meet future load. The net rating is what is typically used for actual day-to-day dispatch for meeting actual customer load, assuming there are no de-rates or other limitations on the availability of capacity.

For long term planning, utilities typically target a reserve margin that is calculated on an installed capacity basis. For purposes of a reserve margin as determined by PJM, an entirely different metric, based upon a calculated unforced capacity rating, is used.

Q. DESCRIBE THE DIFFERENCE BETWEEN INSTALLED CAPACITY AND UNFORCED CAPACITY.

A. Installed Capacity (ICAP) is a MW value based on the summer net dependable capability of a generation unit; specifically, the name plate rating of the unit minus the required auxiliary load. Further, ICAP cannot exceed the capacity interconnection right limits of the bus to which it is connected. The ICAP of a unit does not generally change unless the unit experiences permanent performance degradation or modifications that increase generating output.

Unforced Capacity (UCAP) is the MW value of a capacity resource in the PJM Capacity Market. It is determined annually by PJM based on the methodology mathematically expressed as:

UCAP = ICAP*(1- EFORd) where:

EFORd is the equivalent demand forced outage rate.

Q. PLEASE EXPLAIN THE TERM "EFORd."

A. EFORd is an industry standard measure based on historical performance meant to represent the probability that a generating unit will not be available due to a forced outage or forced derating when called upon to generate. As example, if a 600 MW unit such as East Bend were to have an EFORd of 10percent during the annual year-long pre-delivery year evaluation period; Duke Energy Kentucky would be credited 540 MWs in the PJM capacity market for the following capacity year. The distinction is significant in that for purposes of meeting capacity obligations in PJM, an entirely different analysis must be performed compared to what is used for traditional integrated resource planning (IRP).

III. DUKE ENERGY KENTUCKY'S RESOURCE PLANNING

Q. PLEASE GENERALLY DESCRIBE DUKE ENERGY KENTUCKY'S IRP PLANNING PROCESS.

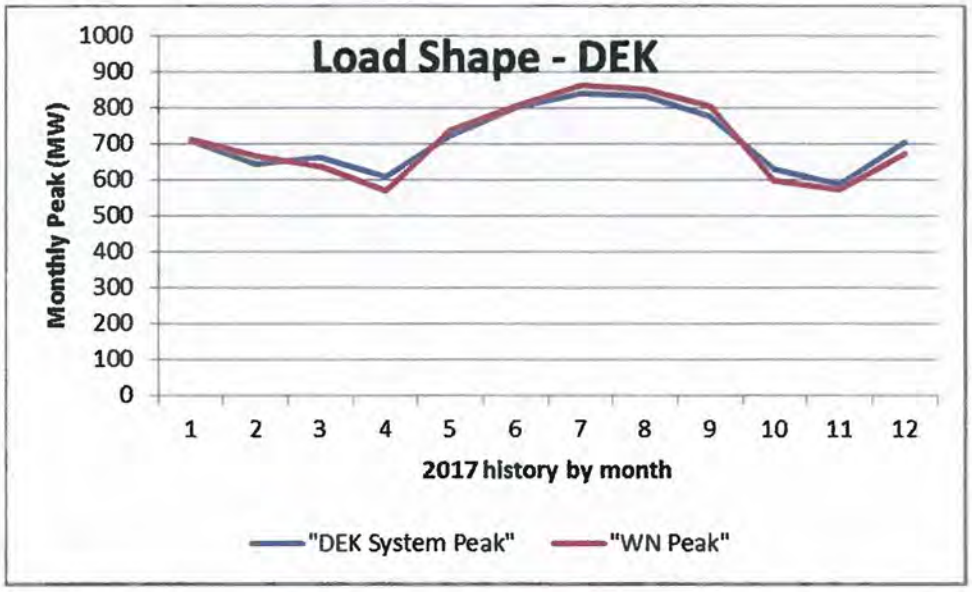
A. The IRP planning process assesses various supply-side, demand-side and emission compliance alternatives to develop a long-term, cost-effective portfolio to provide customers with reliable service at reasonable costs. The IRP planning process involves various assumptions such as future energy prices, future environmental compliance requirements and reliability constraints.

Duke Energy's load forecasting group develops the load forecast by: (1) obtaining service area economic forecasts primarily from Moody's Analytics; (2) preparing an energy forecast by applying statistical analysis to certain variables such as number of customers, economic measures, energy prices, weather conditions, *etc.;* and (3) developing monthly peak demand forecasts by statistically analyzing weather data. The Company updates the load forecasts on a regular basis and the updated load forecasts are used for all modeling analysis. It is important to note that while Duke Energy Kentucky develops internal load forecasts for system planning purposes, the actual load forecast and the Duke Energy Kentucky PJM load obligation, which includes peak coincidence factors and system reserve requirements, is calculated by PJM, and can differ from the Company's internal forecast.

Q. WHAT ARE THE COMPANY'S LOAD REQUIREMENTS?

A. The chart below depicts the shape of the Company's monthly load obligations for the twelve months ended December 2017. The "DEK System Peak" line reflects

actual peak energy demand from customers in each month. The "WN Peak" line reflects a "weather normal" peak demand, adjusted to reflect typical weather conditions at the time of the peak in each month.



Based on the most recent demand forecast, the base case demand and energy forecasts and high case demand and energy forecasts for the current year and the next four years are projected as follows:

	Duke Energy Kentucky – Native Load Forecast			
	Demand – MW		Energy - GWH	
	Base	High	Base	High
2018	847	932	4,025	4,378
2019	852	938	4,043	4,414
2020	857	944	4,065	4,446
2021	862	949	4,084	4,473
2022	867	954	4,084	4,473

Q. PLEASE DESCRIBE DUKE ENERGY KENTUCKY'S PLANNING RESERVE MARGIN FOR IRP PURPOSES AND HOW IT IS CALCULATED.

A. As I previously stated, the IRP models are for long-term resource planning and thus utilize the full net summer capacity of the unit ratings to perform dispatch, so the reserve margin needs to be developed on an installed capacity, or ICAP, rating.

The planning reserve margin target (*i.e.,* minimum amount required) the Company used for 2018 resource planning is 14.5 percent. Duke Energy Kentucky plans for a prudent long-term target reserve margin (typically in the 13%-17% range). Its actual projected reserves based upon the Company's installed capacity (*i.e.,* nameplate minus auxiliary load) using its most recent forecast is stated below. Again. it must be understood that the installed capacity value is not the actual amount of capacity that is available to serve customers or utilized to meet PJM obligations. In addition, this version of reserves and reserve margin does not account for the load obligation imputed by PJM or factor in capacity de-rates due to forced outages.

For purposes of being clear projected reserve margins for IRP planning are calculated as follows:

- Reserve Margin (MW) = Generating Capacity – Peak Demand – Demand Response
- Reserve Margin (%) = (Generating Capacity / (Peak Demand – Demand Response)) - 1

This metric produces the following reserve margins for Duke Energy Kentucky for purposes of traditional IRP planning on a total installed capacity basis.

Year	Projected Reserves (MW)	Projected Reserve Margin (%)
2018	254	31%
2019	250	30%
2020	233	27%
2021	228	27%
2022	223	26%

However, as a participant in PJM, Duke Energy Kentucky must also satisfy a separate PJM prescribed reserve margin requirement as part of its near-term Regional Transmission Organization (RTO) wide capacity planning. These two requirements while similar in name and concept are not the same metric nor are they calculated the same way.

Q. DOES DUKE ENERGY KENTUCKY CURRENTLY HAVE SUFFICIENT CAPACITY TO MEET ITS KENTUCKY CUSTOMER LOAD OBLIGATIONS?

A. Duke Energy Kentucky currently has sufficient capacity to meet its load obligations; however, due to short term variations in load forecasts and generation performance, short-term capacity purchases may be necessary in order to maintain sufficient reserves to meet its capacity obligations in PJM. Currently, there are no planned base load or peaking capacity additions needed to meet native load requirements over the next ten years. Likewise, there are no planned unit retirements to occur in the next ten years.

Q. PLEASE EXPLAIN HOW PJM CALCULATES THE COMPANY'S SYSTEM RESERVE REQUIREMENTS.

A. Duke Energy Kentucky's PJM FRR capacity obligation reflects both the forecasted load of Duke Energy Kentucky's customers as calculated by PJM and the reserve requirement mandated by PJM. When PJM assesses the amount of capacity a load-serving entity is required to commit during the three-year planning horizon as part of its FRR capacity plan (FRR Plan), it defines the obligation quantity in terms of "unforced capacity" value (UCAP). As described above, UCAP is the MW value of a capacity resource in the PJM Capacity Market. UCAP refers to the electric generation capacity that is actually available as a resource to PJM at any given time after discounting for historical facility unavailability due to outages or derating to determine minimum requirements. For demand resources and energy efficiency resources, the unforced capacity value is equal to demand reduction multiplied by the Forecast Pool Requirement.

Q. WHY IS THIS DIFFERENT FROM HOW THE COMPANY CALCULATES ITS RESERVE FOR IRP PLANNING PURPOSES?

A. The primary difference between the IRP view of reserve requirement and the PJM view of reserve requirement is the planning horizon. Other less impactful differences include load forecast modeling differences and PJM's consideration of how the Duke Energy Kentucky load conforms to the broader PJM planning region. Duke Energy Kentucky plans to meet customer requirements over the long term. PJM plans to meet requirements for just the next three years. As such, Duke Energy Kentucky plans for a long-term forced outage expectation while PJM translates recent unit performance directly into capacity capability through the UCAP methodology. Generation station performance naturally varies over time

and Duke Energy Kentucky must plan to be able to meet the PJM requirement during both low EFORd and higher EFORd years.

IV. DUKE ENERGY KENTUCKY'S PARTICIPATION IN PJM

A. OVERVIEW OF PJM

Q. PLEASE GENERALLY DESCRIBE PJM.

A. Duke Energy Kentucky has been a member of PJM since January 1, 2012. PJM is the nation's first fully functioning RTO and manages the power grid and wholesale electric market for all or parts of thirteen states and the District of Columbia. The PJM markets consist of energy, capacity, ancillary services markets, and a financial transmission rights market. PJM's operation is governed by agreements approved by the Federal Energy Regulatory Commission (FERC), including the Operating Agreement, Open Access Transmission Tariff (OATT), and the Reliability Assurance Agreement (RAA). As a member of PJM, Duke Energy Kentucky is subject to these agreements, which among other things require Duke Energy Kentucky to offer all its available generation to PJM and to purchase its customer energy load requirements from the PJM Day-Ahead or Real-Time Energy Markets. The Day-Ahead and Real-Time Energy Markets are collectively referred to as the PJM Energy Market for the remainder of my testimony.

B. PJM'S ENERGY MARKET

Q. PLEASE BRIEFLY DESCRIBE THE PJM ENERGY MARKET.

A. PJM administers its Energy Markets utilizing locational marginal pricing (LMP). LMP can be broadly defined as the value of one additional megawatt of energy at

a specific point on the electric grid. In PJM, LMP is composed of three components: the system marginal energy price; the transmission marginal congestion price; and the marginal loss price. Both the Day-Ahead and Real-Time Energy Markets are based on supply offers and demand bids submitted to PJM by market participants or actual customer demand, including both generator owners (as sellers) and load serving entities (as buyers).

The Day-Ahead Energy Market provides a means for market participants to mitigate their exposure to price risk in the Real-Time Energy Market. The Day-Ahead Energy Market also provides meaningful information to PJM regarding expected real-time operating conditions for the next day, which enhances PJM's ability to ensure reliable operation of the transmission system and economically serve customer demand. The Real-Time Energy Market functions as a balancing market between generation and load in real-time. Through the PJM Energy Markets and the LMP price signals, PJM provides a market-based solution to value and thus manage energy production, transmission congestion, and marginal losses in the PJM region to meet demand in the most cost-effective way.

Q. PLEASE EXPLAIN HOW PJM DISPATCHES GENERATING RESOURCES TO MEET DEMAND IN THE ENERGY MARKET.

A. PJM performs a security constrained economic commitment and least-cost security constrained economic dispatch process that simultaneously optimizes energy and reserves for all generation in its footprint in determining which assets to commit and dispatch. This process takes into account the various, unique challenges faced in reliably and economically supplying energy to all loads across

its footprint, most significantly aligning the production of energy simultaneously with the volatility in demand within the capability of the transmission network. PJM must continually act to account for the fact that customer demand is dynamic in nature, fluctuating over the course of a day, week, and season, while analyzing factors such as costs and operating characteristics of generation from different types of units within its entire footprint and expected and unexpected conditions on the transmission network that affect which generation units can be used to serve load economically and reliably given the numerous constraints that must be considered. Because of these challenges, PJM's dispatch process "is designed to be an optimization process so that a reliable supply of electricity at the lowest cost possible under the conditions prevailing in each dispatch time interval can be delivered."[1]

Importantly, PJM's decisions as to which generating units should be dispatched are not made exclusively based on the individual unit's cost. Although the price of energy at a generating unit is certainly important, PJM's dispatch process must take into account a number of factors, including system-wide reliability, transmission grid congestion and losses, and numerous operational conditions and constraints. PJM has access to complete information regarding the operation of its Day-Ahead and Real-Time Energy Markets in making the determination to commit and dispatch a unit. Because of the efficient and informed nature of PJM's dispatch methodology, a utility's energy purchases in PJM's Day-Ahead and Real-Time Energy Markets are the most efficient and

[1] FERC Docket AD05-13-000, *Report on Security Constrained Economic Dispatch by the Joint Board of PJM/MISO Region*, Attachment 1, at pg. 5 (May 24, 2006).

economic means available to satisfy customer load. Stated another way, energy acquired by all load serving entities (LSEs) from PJM are necessarily and by definition purchased on an economic dispatch basis.

Q. PLEASE EXPLAIN HOW THE COMPANY MEETS ITS ENERGY NEEDS THROUGH THE PJM ENERGY MARKET.

A. Consistent with its PJM membership, the Company meets its energy needs through the PJM Energy Market and does not currently purchase any energy outside of PJM. Through PJM's Day-Ahead Market, market participants can mitigate their exposure to real-time price risk by selling available generation and purchasing forecasted demand in the Day-Ahead Energy Market. Duke Energy Kentucky submits demand bids and supply offers as both LSE and a generator owner, respectively. Thus, the Company simultaneously functions as both a buyer and seller to serve its retail electric customers.

Q. PLEASE BRIEFLY EXPLAIN HOW DUKE ENERGY KENTUCKY'S CURRENT GENERATION PORTFOLIO PARTICIPATES AND IS DISPATCHED IN THE DAY-AHEAD AND REAL-TIME ENERGY MARKETS.

A. Under the terms of PJM's RAA, as a FRR entity and generation owner in PJM, Duke Energy Kentucky is under a must-offer requirement to offer all its generation committed to the FRR plan into the Day-Ahead Energy Market.

In making the decision regarding an individual unit's offer status, the Company considers various factors such as unit availability, forecasted locational marginal prices, unit generation production cost, PJM impacts (Day-Ahead

Operating Reserve credits, balancing operating reserve changes, *etc.*), and the capability, risk, and economic impact from cycling the generating unit off-line and/or on-line. Before making any generation unit offer, Company personnel engage in a daily planning process designed to minimize the total customer cost by maximizing each unit's economic value.

Each generating unit is offered hourly with a segmented incremental energy price pair quantity and ancillary service offer curve across the unit's operational range as well as a start-up cost, no-load cost, and operating parameters. The hourly offers are based on numerous factors, including but not limited to, the daily fuel cost, unit efficiency, emissions and variable operations and maintenance (O&M) costs, maximum and minimum loadings, and plant output availability and physical characteristics. Unit commitment status is determined based upon unit availability, marginal energy costs, expected impact of certain PJM charges and credits, and anticipated market-clearing prices.

Day-ahead generation unit offers are submitted to PJM by 10:30 Eastern Prevailing Time the day prior to energy flow. Generally, by 13:30 Eastern Prevailing Time that day, following execution of a security constrained unit commitment model, PJM posts energy and ancillary services awards for the following day. These awards are financially binding on both Duke Energy Kentucky and PJM.

In real-time, Duke Energy Kentucky makes hourly updates to the energy and ancillary service offers, primarily with respect to unit availability, but also taking into account the unit's operating parameters. The Duke Energy Kentucky

generation dispatchers follow PJM generation dispatch signal instructions and relay necessary instructions to the generation stations.

It is possible that in real-time, despite receiving a day-ahead energy award, PJM dispatch signals will instruct Duke Energy Kentucky units to move to generation loadings other than their day-ahead award level. These instructions are based on the real-time energy and ancillary services needs of the overall system as manifested through LMP price signals at the generator bus. If the real-time LMP is below a unit's marginal cost of energy, PJM will likely reduce output, or possibly delay or cancel a unit startup. Conversely, if system conditions have changed from day-ahead results, PJM may direct a Duke Energy Kentucky unit to start up even without a day-ahead energy award. Duke Energy Kentucky has an obligation and financial incentive to follow PJM dispatch instructions.

C. PJM'S CAPACITY MARKET

Q. PLEASE DESCRIBE THE PJM CAPACITY MARKET.

A. PJM's capacity market is called RPM, which is an acronym for Reliability Pricing Model. The purpose of RPM is to provide a market construct that enables PJM to secure adequate generation resources to meet the reliability needs of the RTO. The RPM construct and the associated rules regarding how PJM members participate in the PJM capacity market is described within the PJM OATT and RAA. The PJM capacity market operates on a planning period that spans twelve months beginning June 1st and ending May 31st of each subsequent year (Delivery Year). In PJM, the capacity market structure is intended to provide transparent forward market signals that support generation and infrastructure investment. There are

two ways for a PJM member to participate in the RPM capacity structure: 1) through the RPM baseline procurement auctions; or 2) as a self-supply FRR entity. The baseline procurement auction is called a base residual auction (BRA). BRAs are conducted three years in advance of the actual Delivery Year to allow bidders to complete construction of projects that clear the BRA. The PJM capacity market is designed to provide incentives for the development of generation, demand response, energy efficiency, and transmission solutions through capacity market payments.

Another important component of RPM is that price signals are locational and designed to recognize and quantify the geographical value of capacity. PJM divides the RTO into multiple sub-regions called locational delivery areas (LDAs) in order to model the locational value of generation.

Q. PLEASE EXPLAIN HOW DUKE ENERGY KENTUCKY CURRENTLY PARTICIPATES IN THE PJM CAPACITY CONSTRUCT.

A. Consistent with the Commission's Order in Case No. 2010-00203, Duke Energy Kentucky is an FRR Entity in PJM. As a condition of Duke Energy Kentucky becoming a member of PJM, the Commission required the Company to participate in PJM as an FRR entity until such time as it received Commission approval to participate in the PJM capacity auctions. To date, the Company has not requested such permission, but continues to evaluate the merits of exiting the FRR obligation and becoming a full RPM auction participant.

Q. PLEASE BREIFLY EXPLAIN PJM'S FRR PROCESS.

A. The PJM OATT and RAA specify the obligations and compensation to LSEs for supplying capacity. The FRR process is an alternative means for a PJM LSE such as Duke Energy Kentucky to satisfy its customer capacity obligation under the PJM RAA. Under the FRR construct, an LSE must annually submit a preliminary three-year forward, and a final current year FRR capacity plan that meets a PJM defined customer capacity obligation. The FRR Plan must identify the unit-specific generating or demand response resources that will be providing the MWs of capacity that will fulfill the LSE's customer obligation. FRR allows the LSE to match its customer reliability requirement to its own generation, demand response, energy efficiency and/or transmission resources, while still being permitted to sell some or all of its excess supply into RPM. Duke Energy Kentucky would face severe penalties and limitations on its ability to choose the FRR option if PJM were to deem either its initial or final FRR plans to be insufficient or it's generation otherwise non-compliant with PJM requirements.

Q. PLEASE EXPLAIN WHAT BEING AN FRR ENTITY MEANS FOR DUKE ENERGY KENTUCKY.

A. As an FRR entity, Duke Energy Kentucky must secure and commit unit-specific generation resources to meet the full load capacity requirements for all of its customers in advance of the PJM BRA through its FRR Plan. The FRR Plan is forward-looking in that it covers the Delivery Year three years into the future. For example, as part of its most recent FRR plan submitted in 2018, Duke Energy Kentucky must own or contract and commit the unit specific generation resources to satisfy its forecasted load requirements for the period from June 1, 2021,

through May 31, 2022. Presently, the load requirements include both the forecasted load of Duke Energy Kentucky's customers, as well as the reserve requirement mandated by PJM.

Q. PLEASE EXPLAIN WHAT YOU MEAN BY THE PHRASE UNIT-SPECIFIC GENERATION RESOURCES.

A. A unit-specific generation resource, as the phrase implies, simply means a specific generating resource that meets the eligibility requirements defined by PJM. PJM eligible resources include both physical and demand-side management resources. Duke Energy Kentucky must identify the specific generation resources it owns or has contracted for to provide capacity to meet its entire Delivery Year FRR obligation. Unit-specific capacity is distinguishable from the more "generic" buy-bid capacity that may be purchased through the BRA or incremental auctions of PJM. The capacity product available for purchase in those auctions is not directly tied to a specific generator, so it cannot, in itself, be used to satisfy an FRR plan obligation. While sellers in the BRA identify the generation resource offered into the auction, the end product is not so specific. The entire generator performance obligation in the BRA is to PJM, not the purchaser of the buy-bid capacity. From the purchaser's perspective, buy-bid capacity has guaranteed deliverability and performance by PJM. This is distinguishable from the FRR entity where the performance obligation of generation committed to FRR plans is the responsibility of the FRR entity.

As such, Duke Energy Kentucky has similar performance risk to RPM entities, but less flexibility to adjust its plan to account for changes in its resource

requirements between the BRA and the Delivery Year than an RPM participant who can simply buy and sell capacity to meet its needs through the BRA.

Q. HOW DOES DUKE ENERGY KENTUCKY CURRENTLY MEET ITS FRR CAPACITY OBLIGATION IN PJM?

A. Presently, the Company's PJM capacity obligations as an FRR Entity reflect both the forecasted load of Duke Energy Kentucky's customers as determined by PJM, as well as the reserve requirement mandated by PJM. First, PJM performs a load forecast for the Company and applies an approximate 15 percent reserve to that load obligation. To satisfy this load obligation, Duke Energy Kentucky relies heavily upon the unit-specific capacity of its East Bend and Woodsdale generating stations to serve the PJM-forecasted load obligation and thus fulfill its FRR capacity plan. The newly in-service 6.8 MW solar facilities will provide some additional capacity to provide a buffer for the Company in meeting FRR obligations. Directly, the capacity value of solar resources is limited in the PJM capacity market. Indirectly, however, over time and to the extent that the solar generation is online during peak periods, the load forecast will reflect the full reduction in peak load requirements.

East Bend and Woodsdale stations alone are not always sufficient to satisfy 100 percent of the Company's total FRR obligation. As a result, the Company relies upon the availability of its DSM programs to both manage energy requirements by reducing or temporally shifting customer load, and for capacity purposes through demand response programs, which are includable in its FRR plan as capacity resources.

Q. PLEASE EXPLAIN HOW DUKE ENERGY KENTUCKY RELIES UPON DEMAND RESPONSE AND ENERGY EFFICIENCY PROGRAMS IN ITS DSM PORTFOLIO TO MEET ITS FRR PLAN.

A. Duke Energy Kentucky has already executed contracts under its PowerShare® program where customers commit to load curtailment, if needed, during the Company's peak operating periods. These demand response load management programs are includable in the Company's FRR plan and enable the Company's customers to have an opportunity to participate, albeit through the Company's own DSM programs, in the PJM markets.

The tables below demonstrate the Company's historic and future FRR position and reserve, as determined by PJM, both with and without the inclusion of Duke Energy Kentucky's demand response programs offered as part of its DSM portfolio of programs. Table 1 below illustrates the Company's FRR Plan reserve margins with and without Demand Response resources based on planning parameters in place at the time that the initial FRR plans were submitted to PJM. It is important to note again that UCAP is directly impacted by the forced outage value applied. A higher forced outage value inversely affects the capacity that Duke Energy Kentucky can utilize in its FRR plan. In the initial FRR plan, the Company must apply either the previous year's actual outage rate or the average of the previous five years outage rates, at its discretion. The final FRR plan however, must utilize the actual previous years forced outage rate. PJM's approval of the initial FRR plan is the most significant milestone in the three-year FRR planning process timeline. Table 1 clearly shows that absent additional

capacity purchases, PJM could have deemed Duke Energy Kentucky's FRR plan deficient during three Planning Years. Failure to secure PJM's approval of the FRR Plan results in significant penalties on the shortfall, further additional reserve margin penalties on the entire load forecast, and forced exit from the FRR construct.

TABLE 1:

DEK Initial FRR Position

Planning Year	EFORD		Total UCAP MW		PJM Load Obligation	FRR Position		Excess Based on Load	
	East Bend	Woodsdale	Gen	DR		w/ DR	w/o DR	w/ DR	w/o DR
2011/2012	4.4%	10.0%	947.6	42.3	(930.5)	59.4	17.1	6.4%	1.8%
2012/2013	5.4%	5.1%	980.6	42.4	(959.2)	63.8	21.4	6.7%	2.2%
2013/2014	1.7%	3.0%	1005.7	38.3	(986.5)	57.5	19.2	5.8%	1.9%
2014/2015	3.4%	4.4%	992.7	36.6	(1004.9)	24.4	(12.2)	2.4%	-1.2%
2015/2016	4.2%	3.2%	994.9	45.1	(979.9)	60.1	15.0	6.1%	1.5%
2016/2017	4.9%	6.5%	967.7	44.8	(996.1)	16.4	(28.4)	1.6%	-2.9%
2017/2018	6.8%	4.6%	964.8	31	(1006.5)	4.3	(41.7)	0.4%	-4.1%
2018/2019	9.3%	3.2%	991.6	31.9	(981.4)	42.1	10.2	4.3%	1.0%
2019/2020	3.5%	2.8%	1028.5	16.3	(944.4)	100.4	84.1	10.6%	8.9%
2020/2021	9.8%	6.2%	974.7	10.9	(974.7)	10.9	0.0	1.1%	0.0%

This table clearly shows that absent the Company's demand response programs in its DSM portfolio, the Company's Initial FRR Plan would have been deficient in the current delivery year and two of the last three prior years requiring bilateral purchases of capacity from the market.

While the initial FRR plan is based on forecasted loads and forecasted forced outage rates, Table 2 below illustrates Duke Energy Kentucky's capacity position at the time that the Final FRR plan was submitted to PJM.[2] This table utilizes final actual PJM load obligations and unit performance metrics through the 2018/ 2019 planning year.

TABLE 2:

DEK Final FRR Position

Planning Year	EFORD		Total UCAP MW		PJM Load Obligation	FRR Position		Excess Based on Load	
	East Bend	Woodsdale	Gen	DR		w/ DR	w/o DR	w/ DR	w/o DR
2011/2012	4.4%	10.0%	947.6	42.3	(930.5)	59.4	17.1	6.4%	1.8%
2012/2013	5.4%	5.1%	980.6	42.4	(925.0)	98.0	55.6	10.6%	6.0%
2013/2014	7.7%	12.4%	908.1	35.4	(943.3)	40.2	4.8	4.3%	0.5%
2014/2015	14.8%	5.7%	921.8	27	(972.4)	30.4	3.4	3.1%	0.3%
2015/2016	15.6%	7.9%	931.7	36.2	(955.5)	15.8	(20.4)	1.7%	-2.1%
2016/2017	3.5%	3.8%	1023.7	28.7	(918.7)	133.7	105.0	14.6%	11.4%
2017/2018	9.8%	3.2%	988.4	27	(970.5)	11.9	(15.1)	1.2%	-1.6%
2018/2019	7.2%	9.4%	975.6	15	(969.5)	21.1	6.1	2.2%	0.6%
2019/2020	9.9%	7.9%	966.4	16.3	(944.4)	38.3	22.0	4.1%	2.3%
2020/2021	9.9%	7.9%	966.4	10.9	(974.7)	2.6	(8.3)	0.3%	-0.9%

For the 2019/2020 and 2020/2021 delivery years, the Company used the lower of EFORD and EFORD-5YR in its initial FRR Plan. PJM's tariff provides this flexibility for determining the initial FRR Plan. However, the Final FRR Plan rules do not provide such flexibility and thus the Company has used the EFORD-5YR to better reflect our FRR position.

[2] Table 2 does not depict the capacity purchases and sales that occurred during certain delivery years to meet the Company's FRR Plan. The purchases and sales however, are included in the calculation of the "excess based on load" percentages in the final columns. The Company had the following capacity transactions in specific delivery years: purchased 40 MWs of capacity in 2013/2014; purchased 54 MWs in 2014/2015, purchased 3.4 MWs in 2015/2016, and sold 33 MWs in 2017/2018.

As is clearly indicated, even with demand response programs, the Company's actual operating capacity position in PJM is razor thin at best. Absent demand response, the Company's FRR Plan would be deficient in the current delivery year and potentially future years.

Q. WHAT DOES THE LOSS OF DEMAND RESPONSE PROGRAMS LIKE POWERSHARE® AND POWER MANAGER® MEAN TO DUKE ENERGY KENTUCKY?

A. Duke Energy Kentucky currently has approximately 18MWs of PowerShare® capacity under contract for the 2018/2019 delivery year in addition to 14MWs from Power Manager®, which is embedded in the demand response component of its FRR Plan. Loss of these MWs of capacity in the short and long term will mean the Company will have to find other unit-specific capacity resources that have not otherwise been committed in a base residual auction to fill the void in the FRR Plan. Suspension and elimination of the PowerShare® and Power Manager® program that is offered as part of the Company's DSM portfolio will have a substantial impact on the Company's ability to satisfy its obligations in PJM.

Q. PLEASE EXPLAIN THE POTENTIAL PENALTIES THE COMPANY COULD FACE IF IT DOES NOT HAVE SUFFICIENT RESOURCES TO MEET ITS FRR OBLIGATION.

A. The easiest way to explain is through a specific example. If Duke Kentucky had been unable to utilize its demand response resources for the 2017/2018 Planning Year and could not purchase unit specific capacity to include in its initial FRR plan for a delivery year, it would have been subject to a penalty of two times the

Planning Year Cost of New Entry (CONE) on the 41.7 MW deficiency plus an additional three percent of the load obligation penalty of 30.2 MWs.

Specifically: (Plan Deficiency + 3% of load) * (DEOK CONE in $/MW Year) * 2. Or: (41.7 + 30.2) * $143,670 * 2 = $20,298,847.

Should the Company immediately lose the ability to recognize its DSM programs (and their resulting demand-response capacity benefits) as part of the Company's FRR Plan, it will come dangerously close to falling short of its PJM capacity obligations and be required to purchase unit-specific capacity from the market at a premium calculated at PJM's tariffed shortfall penalty of a multiple of the base residual auction clearing price.

While the plan deficiencies shift and the penalty impact is less severe once the Company submits its final FRR plan, (1.2 times the base residual auction clearing price for the year), as demonstrated in Table 2, there remains three planning years where Duke Energy Kentucky would not have enough resources to meet its PJM obligation absent the ability to rely upon demand response programs.

Q. IS DUKE ENERGY KENTUCKY ABLE TO PURCHASE CAPACITY IN PJM AS AN FRR ENTITY?

A. As an FRR entity, the Company is limited to the bilateral capacity market in PJM to meet any capacity shortfalls. The Company cannot purchase capacity through the BRA to meet its FRR Plan obligations. This limitation exists because the capacity product in the BRA does not meet the unit specificity requirements for an FRR Plan. While the Company can theoretically purchase capacity from

outside the PJM footprint, deliverability constraints of imports significantly limit this option. The Company is effectively limited to its own internal capacity resources, including demand response, and the PJM bilateral market to meet its FRR capacity plan obligations. I describe further below, additional limitations on bilateral capacity during delivery years where the Duke Energy Ohio/Kentucky (DEOK) delivery zone "separates" from the more generic RTO zone.

The bilateral markets characteristically lack liquidity as uncommitted unit-specific capacity resources, that would be required to meet any FRR plan deficiencies are scarce in the short-term. This is because the only unit-specific capacity available in the bilateral market is capacity that did not otherwise clear and is not committed in the BRA for that delivery year.

Q. HAVE THERE BEEN ANY RECENT SHIFTS IN DUKE ENERGY KENTUCKY'S ACCESS TO UNIT-SPECIFIC GENERATION RESOURCES THROUGH THE BILATERAL CAPACITY MARKET IN PJM?

A. Yes. In the most recently conducted PJM Base Residual Auction, for the 2020/2021 Delivery Year, capacity in the DEOK zone cleared with a LDA adder of $53.47/ MW-day to the $76.53/ MW-day general clearing price known as "Rest of RTO." I explain the operational mechanics of this separation later in my testimony; but the total clearing price for the DEOK zone was $130/ MW-day. While there is no guarantee that DEOK zone capacity will continue to clear at a premium to the more generic capacity in the RTO, this zonal "separation" does

create the potential that Duke Energy Kentucky's access to unit-specific capacity could be constrained, priced at a premium, or be unavailable at any price.

During constrained delivery years, if the Company must purchase capacity from the bilateral market to meet its FRR obligation, Duke Energy Kentucky would be limited, and thus required, to purchase any capacity to meet its FRR obligation from generation resources deliverable to the DEOK zone. In general, resources located in a constrained LDA can serve as replacement capacity for a generation resource located in a less constrained parent LDA. Based on the 2020/2021 BRA results, only resources in 5 of the 14 LDAs can be used for replacement capacity resources in DEOK zone, effectively diminishing the pool of eligible replacement resources for DEOK zone. If Duke Energy Kentucky needs to purchase capacity in the bilateral market, it is limited to resources in the following LDAs: 1) EMAAC; 2) PS; 3) PSNORTH; 4) DPLSOUTH; and 5) COMED. From a practical perspective, the fact that these resources are deliverable to DEOK means that they cleared at a higher price and excess capacity is even more scarce than the limited availability in the DEOK zone. PJM also sets annual minimum requirements of generation physically located within a zone that must be adhered to, potentially limiting the ability to include higher clearing generation from other constrained zones.

This loss of liquidity exists regardless of whether Duke Energy Kentucky remains an FRR entity or moves at some point to full RPM participation for as long as the zonal separation exists. Absent a change in PJM's rules and tariffs, the same would hold true for any delivery year in the future in which the DEOK zone

separates from the rest of PJM. This situation presents a serious risk and concern to the Company if it cannot rely upon or use any demand response or other qualifying EE or DSM programs as part of its FRR plan.

Because Duke Energy Kentucky's resources generally match expected load obligation for the planning period, continued investment in the Company's existing generating assets for dedicated use in its FRR plan is a crucial piece of the Company's strategy to serve customers. Reliance upon demand response is a crucial strategy for the Company to meet its obligations in the short- and long-term. As such, deviations from the plan driven by either change to load requirements, resource capability or resource unforced capacity could affect costs, and potentially drive deficiencies in FRR Plans.

Q. PLEASE PROVIDE AN ANALYSIS OF THE COMPANY'S ABILITY AND ESTIMATED COSTS TO SECURE, BY BILATERAL CONTRACTS OR OTHER MEANS, ANY CAPACITY AND ENERGY THAT MAY BE NEEDED IN THE FUTURE DUE TO THE TERMINATION OF NON-INCOME BASED DSM PROGRAMS.

A. As I have stated elsewhere in my testimony, recent developments in the PJM capacity construct and marketplace have both limited liquidity and complicated bilateral capacity transactions. The requirements regarding unit performance complicate contractual terms and conditions, particularly at lower capacity prices. Sellers of excess capacity are understandably unwilling to accept contractual responsibility for PJM Capacity Performance (CP) non-performance assessment

risks that can dwarf revenues; and buyers of CP are understandably cautious about buying capacity with no assurance of performance from the seller.

The separation of the DEOK delivery zone further complicates bilateral transactions by limiting to pool of potential resources that meet constrained LDA deliverability criterion. Given the forward nature of a potential need to purchase capacity and the unknown impact of the variables that would drive a shortage, capacity purchase planning remains fluid and responsive to short term requirements. That does not mean, however, that the Company does not remain active in the markets and mindful of options should that need occur. There are other factors that drive the supply side of the capacity balance equation, most notably unit performance of East Bend and Woodsdale; but also including changes in load forecast or other requirements from PJM. Assuming no step change those other variables, if Duke Energy Kentucky were to lose access to its DSM programs, it is likely that the potential shortage would likely be in the 20 MW range. That small quantity limits reasonable options to bilateral transactions. It would not be prudent to build such a small generator or partner with another utility or merchant generator to build a larger facility. Consequently, the Company must estimate the potential costs of capacity from market sources. The energy market is relatively transparent for the short term future. Current prices remain flat for the next three or four years. The capacity market, however, is less transparent and participants generally need to interpret market signals more. For small amounts of capacity, the Company feels that past auction results provide a reasonable proxy for potential costs. Recent BRA results at unconstrained

delivery zones have ranged from roughly $75/MW day to $150/MW day. As example, with those bookends, 20 MWs of replacement capacity would be valued between roughly $500,000 and $1,000,000. Complicating the analysis for Duke Energy Kentucky, is the potential that the DEOK zone remains constrained beyond the 2020/2021 Delivery Year. Constrained zones can clear up to the net CONE (NET CONE), which can approach $300/MW day.

Q. DOES THE COMPANY HAVE ANY OTHER ALTERNATIVES TO MEETING CAPACITY REQUIREMENTS IN PJM?

A. Yes, the Company could contract for the purchase of generation either built or planned to be built or it could build its own new generation. Additionally, the Company could leave the FRR self-supply construct and purchase any capacity shortfall from PJM directly through the RPM capacity auctions. Given the generally small amount of anticipated new generation needs and the potential risks of leaving the FRR, the Company does not believe these options to be either cost effective or in the best interests of our customers.

Q. DO DSM PROGRAMS PROVIDE ANY VALUE IN ADDITION TO CAPACITY VALUE?

A. Yes, in addition to the explicit capacity value of DSM programs in meeting the FRR plan requirements, these programs, specifically the load control and load modification programs PowerShare® and Power Manager® provide benefits in the energy markets. Mr. Duff explains these programs in his testimony. Programs such as these provide additional benefits by shifting customer energy demand and usage away from extreme peak periods, which are highly correlated to high

energy price periods. These programs create opportunities to either displace higher priced generation that would otherwise be allocated to serve native load requirements, or create headroom for non-native energy sales to PJM. These reductions in demand, even if they are simply temporal shifts of usage create direct savings to customers through reduced purchased power costs or through non- native margins, the large majority of which flow to customers through the Company's profit sharing mechanism, (Rider PSM). To the extent the Company is able to achieve off-system sales (energy, capacity, ancillary services, etc.,) the net margins are shared with customers as a credit on their bills.

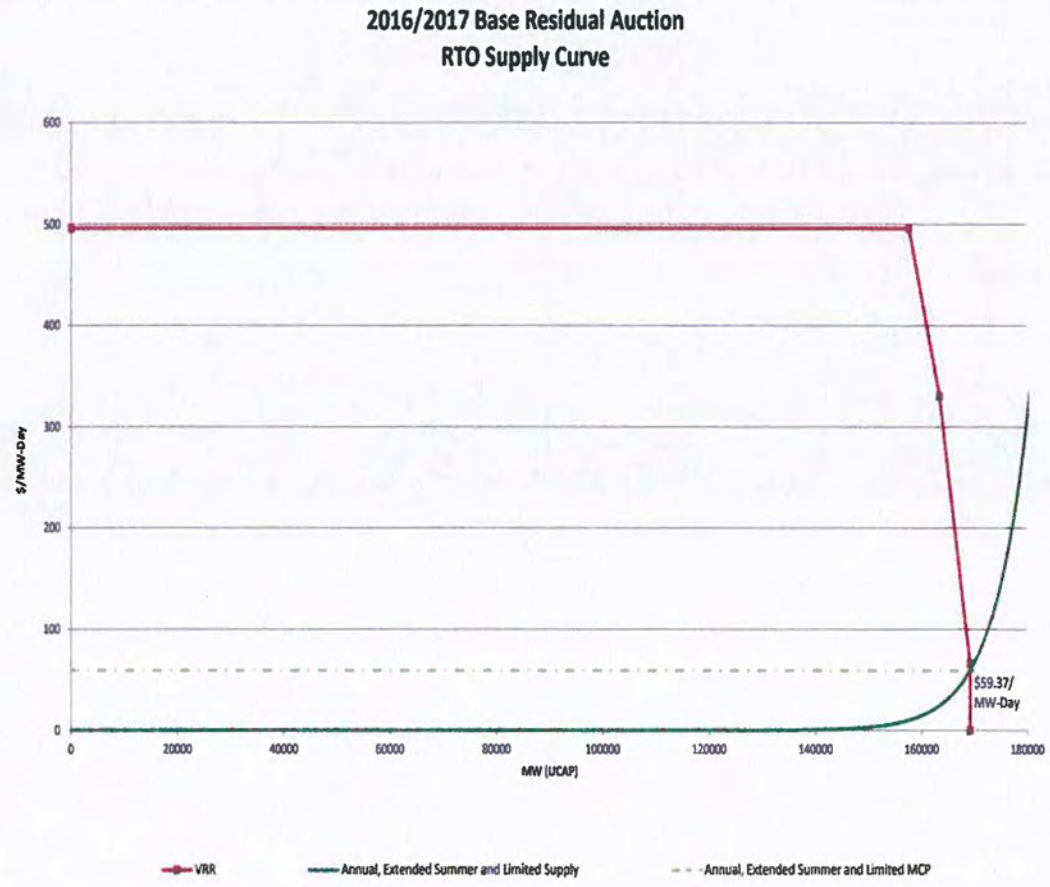
Q. IS ALL CAPACITY VALUED THE SAME IN PJM?

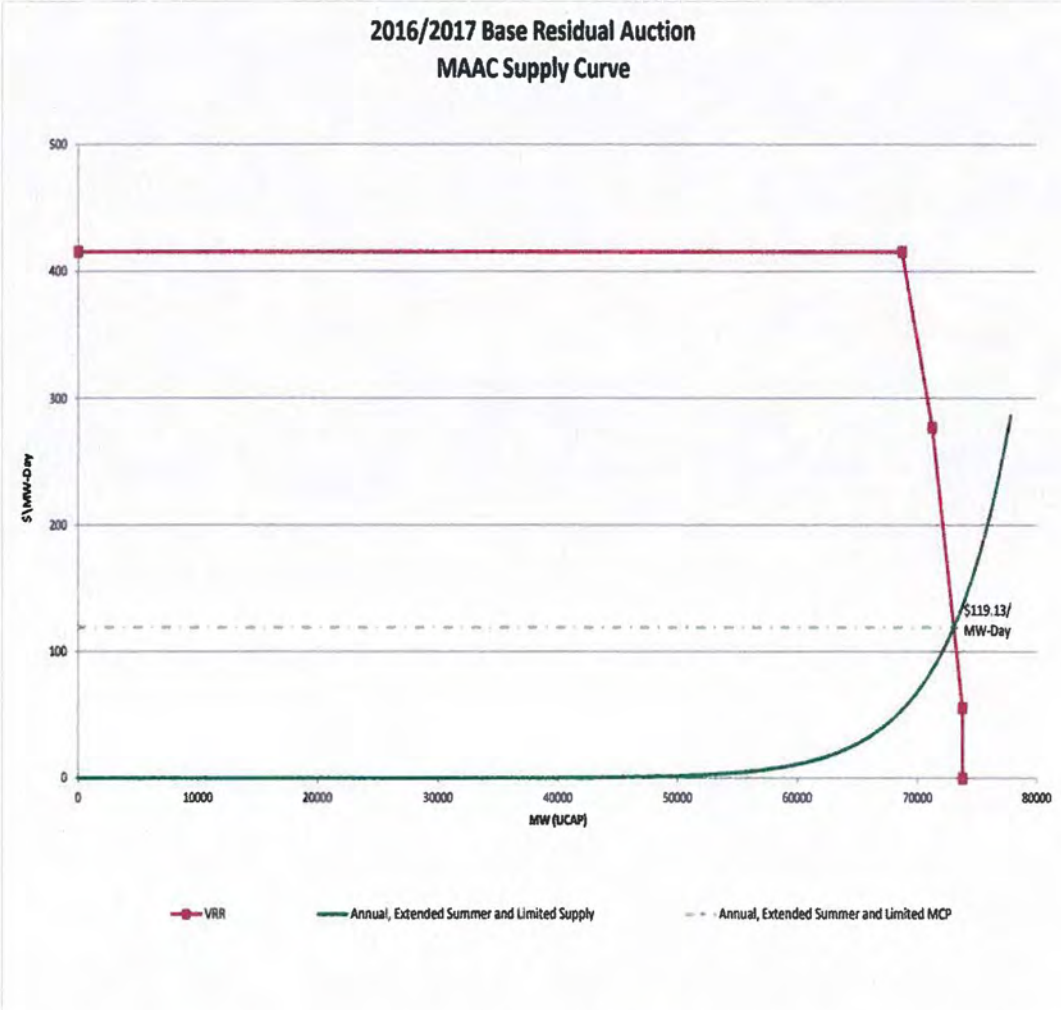
A. No, one of the fundamental properties of the PJM energy market is the concept of locational pricing. Simply put, generation in PJM is compensated based on the value it provides to the grid at its specific physical location. In the energy markets that value typically manifests itself as either positive prices for generation that relieve broader transmission constraints or punitively through low or even negative prices for generation that contributes to or creates constrains on the PJM system. The capacity market construct is analogous. As noted earlier in my testimony, PJM has defined sub regions generally delineated by the stand alone transmission system footprints of the pre PJM systems. The DEOK zone is an example.

As part of the pre delivery year BRA process, PJM analyzes capacity requirements in each of the zones as well calculated import and export limits into and out of the zones. These LDAs are used to recognize and quantify the

locational value of capacity within the PJM region. The import limit into an LDA is known as the Capacity Emergency Transfer Limit (CETL). The LDA capacity requirement is known as the Capacity Emergency Transfer Objective (CETO). If the comparison of these two metrics reveals a shortfall the LDA separates from the broader RTO. As a constrained LDA, an auction is cleared for that specific zone. The solution, or clearing price, is specific to those LDAs requirements. Supply that is procured in the RPM multi-auction clearing ensures that sufficient resources are committed to meet the total footprint reliability requirement. The graphs below illustrate the auction solutions for the 2016/2017 Base Residual Auctions for the broad RTO zone and the constrained MAAC zone. Each zone has defined supply and demand curves.[3] The point that these curves intersect represents the clearing price for that zone.

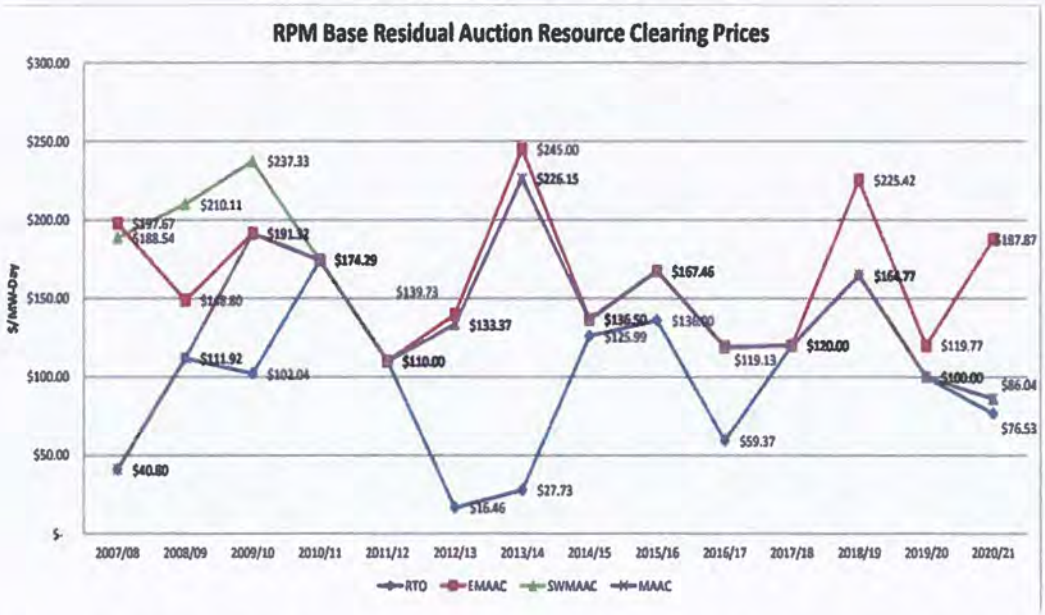
[3] http://pjm.com/-/media/markets-ops/rpm/rpm-auction-info/2016-2017-base-residual-auction-supply-curves.ashx?la=en


2016/2017 Base Residual Auction
RTO Supply Curve
$/MW-Day
600
500
400
300
200
100
0
0
20000
40000
60000
80000
100000
120000
140000
160000
180000
MW (UCAP)
$59.37/
MW-Day
VRR
Annual, Extended Summer and Limited Supply
Annual, Extended Summer and Limited MCP



For comparison purposes, the chart below highlights significant zonal separations in PJM Base Residual Auctions since the 2007/2008 delivery year.[4]

[4] https://www.pjm.com/~/media/markets-ops/rpm/rpm-auction-info/2020-2021-base-residual-auction-report.ashx



Q. HAS CAPACITY PERFORMANCE IMPACTED THE BILATERAL MARKET OR THE ABILITY TO CONTRACT FOR CAPACITY IN THE BILATER MARKET?

A. Yes. While Duke Energy Kentucky has not had the need to purchase Capacity Performance capacity to date, it expects that given the significant performance requirements and consequent non-performance assessments inherent in the Capacity Performance construct, assigning contractual responsibility for unit performance in a bilateral capacity agreement will be complicated at best. At worst, with potentially limited liquidity and limited alternatives, the Company's bargaining position in such negotiations could be compromised.

Q. DO RENEWABLE RESOURCES CURRENTLY GET NAMEPLATE CAPACITY VALUE IN PJM?

A. Not currently. In general, the capacity value for a wind or solar resource represents that amount of generating capacity, expressed in megawatts that it can reliably contribute during summer peak hours and which can be offered as

unforced capacity into the PJM capacity markets. The "Capacity Factor" for a wind or solar capacity resource is a factor based on historical operating data and/or the Class Average Capacity Factor. The capacity factor applied to solar resources is typically 38%, meaning that for every 100 MW of solar energy, 38 MW are eligible to meet capacity requirements.

Q. ARE THERE ANY INITIATIVES IN PJM THAT WOULD MAKE SUMMER ONLY DSM PRODUCTS MORE VALUABLE AS CAPACITY?

A. Yes, in late February, PJM chartered the Summer-Only Demand Response Senior Task Force (SODRSTF). The Task force charter includes recommending ways to better integrate Demand Response into the PJM Capacity Performance construct; specifically resources that cannot currently fully participate due to seasonal limitations. PJM expects the task force to have recommendations by fourth quarter of 2018. Modifications to current rules could increase the value of current programs as capacity resources if more of the seasonal DSM products can be directly utilized as capacity resources. Duke Energy Kentucky will monitor and participate in the task force discussions.

Q. CAN THE COMPANY JUST LEAVE ITS FRR STATUS AND BECOME A FULL RPM PARTICIPANT?

A. No. Duke Energy Kentucky regularly evaluates the merits and risks of full participation in the RPM capacity construct. To date, the Company has not determined full RPM participation to be in customers' best interests. Nonetheless, assuming the Company was to determine such a change to be beneficial to the Company and its customers, even a voluntary move cannot and should not happen

overnight. Indeed, even if the Company were in a position to exit the FRR participation and enter into the PJM Base Residual Auction construct, the earliest the Company could make such a transition would be June 1, 2022.

This is because the BRA construct is for three years in the future. The capacity procurement auctions for the 2018/2019, 2019/2020, 2020/2021 have already occurred. The auction for the 2021/2022 delivery year is about to occur in May, 2018, and the Company has missed its opportunity to declare it would participate in that auction. As a result, the earliest the Company could transition to a full BRA participant would be for the 2022/2023 delivery year, the auction to occur in May 2019.

Q. DOES BECOMING A FULL RPM PARTICIPANT PRESENT ANY ADDITIONAL RISKS ON DUKE ENERGY KENTUCKY?

A. Recent litigation at the DC Circuit Court of Appeals regarding PJM's capacity market and specifically the Minimum Offer Price Rule (MOPR) introduce significantly more risk to Duke Energy Kentucky and its customers if it were forced into full participation in the base residual auction construct. This litigation effectively eliminated the self-supply exemption from the MOPR. If the suspension of these programs and the resulting impact to the Company's FRR Plan necessitates the Company leaving the FRR obligation and transitioning to the PJM base residual auction process where all capacity is purchased from PJM Duke Energy Kentucky's customers may be adversely impacted.

In the RPM construct, LSE's are required to purchase all capacity from the market, and all owned generation must be offered into the capacity market. Under

the MOPR, new generation that enters the RPM must be priced at NET ASSET CLASS CONE until it clears the BRA. This means that Duke Energy Kentucky's Woodsdale stations would be subject to the MOPR and would have to be priced in the BRA at NET CONE. If the BRA clears at a price below the ASSET CLASS NET CONE, the Company's stations would not clear the auction and the Company would have to be a 100 percent purchaser of capacity without any offsetting sales. With the potential price restrictions of the MOPR, Duke Energy Kentucky's customers could potentially face the situation of being forced to purchase capacity in the market with no offsetting benefit of the revenues from generating resources that are able to clear the auction.

While maintaining the capacity value of the demand response programs may not guarantee that Duke Energy Kentucky will never have to leave the FRR construct, losing the ability to rely upon these assets to meet our FRR plan obligations does increase the risk of an untimely FRR exit. A poorly timed or forced exit from FRR that exposes Duke Energy Kentucky's customers to full MOPR price mitigation could have a significant impact to customers. For example, if customers were fully exposed to an average PJM capacity clearing price of $100/ MW Day, while being forced to offer its generation capacity at a level above that which did not clear the market, the resulting cost/revenue mismatch would be roughly $17 Million per year.

V. CONCLUSION

Q. DOES THIS CONCLUDE YOUR PRE-FILED DIRECT TESTIMONY?

A. Yes.

VERIFICATION

STATE OF NORTH CAROLINA)
) **SS:**
COUNTY OF MECKLENBURG)

The undersigned, John Verderame, Managing Director of Power Trading & Dispatch, being duly sworn, deposes and says that he has personal knowledge of the matters set forth in the foregoing testimony and that it is true and correct to the best of his knowledge, information and belief.

John Verderame, Affiant

Subscribed and sworn to before me by John Verderame on this 10 day of April, 2018.

NOTARY PUBLIC

My Commission Expires:

MARY B VICKNAIR
NOTARY PUBLIC
Davie County
North Carolina
My Commission Expires Sept. 21, 2022