COMMONWEALTH OF KENTUCKY

BEFORE THE PUBLIC SERVICE COMMISSION

In the Matter of:

ELECTRONIC APPLICATION OF DUKE ENERGY KENTUCKY, INC. FOR A CERTIFICATE OF PUBLIC CONVENIENCE AND NECESSITY TO CONVERT ITS WET FLUE GAS DESULFURIZATION SYSTEM FROM A QUICKLIME REAGENT PROCESS TO A LIMESTONE REAGENT HANDLING SYSTEM AT ITS EAST BEND GENERATING STATION AND FOR APPROVAL TO AMEND ITS ENVIRONMENTAL COMPLIANCE PLAN FOR RECOVERY BY ENVIRONMENTAL SURCHARGE MECHANISM	)	CASE NO. 2025-00002

CONFIDENTIAL DIRECT TESTIMONY OF

JOHN A. VERDERAME

ON BEHALF OF

DUKE ENERGY KENTUCKY, INC.

January 28, 2025

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I. INTRODUCTION AND PURPOSE

Q. PLEASE STATE YOUR NAME AND BUSINESS ADDRESS.

A. My name is John A. Verderame, and my business address is 525 South Tryon Street, Charlotte, North Carolina 28202.

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

A. I am employed by Duke Energy Progress, LLC (Duke Energy Progress), as Vice President, Fuels & Systems Optimization for Duke Energy Corporation (Duke Energy). Duke Energy Progress is a public utility that is an affiliate of Duke Energy Ohio, Inc. (Duke Energy Ohio or the Company), both of which are subsidiaries of Duke Energy Corporation (Duke Energy).

Q. PLEASE BRIEFLY DESCRIBE YOUR EDUCATION AND PROFESSIONAL EXPERIENCE.

A. I received a Bachelor of Arts degree in Economics from the University of Rochester in 1983, and a Masters in Business Administration in Finance from Rutgers University in 1985. I have worked in the energy industry for 24 years. Prior to that, from 1986 to 2001, I was a Vice President in the United States (U.S.) Government Bond Trading Groups at the Chase Manhattan Bank and Cantor Fitzgerald. I joined Duke Energy's predecessor, Progress Energy Inc. (Progress Energy), in 2001. In 2012, upon consummation of the merger between Duke Energy Corp. and Progress Energy, Progress Energy became Duke Energy Progress, LLC, and I was named Managing Director, Trading and Dispatch. As Managing Director, Trading and Dispatch, I was responsible for Power and Natural Gas Trading and Generation Dispatch on behalf of Duke Energy's regulated utilities in the Carolinas, Florida, Indiana, Ohio, and Kentucky. I assumed my current position as Vice President, Fuels & Systems Optimization in November 2019.

Q. PLEASE SUMMARIZE YOUR RESPONSIBILITIES AS VICE PRESIDENT FUELS AND SYSTEMS OPTIMIZATION.

A. As Vice President, Fuels & Systems Optimization, I oversee the overall strategic direction and commercial management of the purchase, delivery, and storage of fossil fuels that the Duke Energy regulated utilities use for the generation of electricity. This includes monitoring and providing strategic guidance in the various areas of fuel markets, including feedback regarding supply and demand, price, quality, availability, economics, and deliverability. In addition, I am also responsible for the overall strategic direction of the fleet's power trading, system optimization, energy supply analytics, and contract administration functions. I lead the organization responsible for the purchase and delivery of coal, natural gas, fuel oil, and reagents to Duke Energy's regulated generation fleet. My teams also manage Duke Energy's power trading, system optimization, energy supply analytics, and contract administration functions, including those that relate to Duke Energy Kentucky.

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

A. Yes. Most recently, I provided testimony in Case No. 2019-00271 supporting Duke Energy Kentucky's Application for an increase to its electric rates.

Q. WHAT IS THE PURPOSE OF YOUR TESTIMONY IN THESE PROCEEDINGS?

A. The purpose of my testimony is to discuss commercial activity and the supporting economic analysis related to the operation of the Company's East Bend Generating Station (East Bend) that specifically relate to the Company's need to convert its lime-based wet flue gas desulfurization (WFGD) process to a limestone-based system (Limestone Conversion Project) and request for an amendment to Duke Energy Kentucky's Environmental Compliance Plan (ECP) to include the construction, operation, maintenance and recovery as part of the environmental surcharge mechanism (ESM). In doing so, I provide an overview of East Bend, its operation, and discuss the increased cost and volatility experienced in the Company's reagent procurement and the risk the Company is facing with securing necessary reagents that are compatible with the current scrubbing processes at East Bend. I discuss the steps Duke Energy Kentucky has taken to try to procure a reliable source of cost-effective reagent supply, the alternatives evaluated, and the reason the Company is now seeking authority to construct a new limestone-based scrubbing technology for East Bend's WFGD. Finally, I describe the Company's current ECP and ESM depicted in Attachment JAV-1 to my testimony and support the Company's request to amend both to include the construction, operation, and maintenance of the Limestone Conversion Project.

II. DUKE ENERGY KENTUCKY'S LIMESTONE CONVERSION PROJECT OVERVIEW

Q. PLEASE DESCRIBE EAST BEND.

A. East Bend is a 648-megawatt (MW) (nameplate rating) coal-fired base load unit located along the Ohio River in Boone County, Kentucky, which was commissioned in 1981.[1] Previously, Duke Energy Kentucky jointly owned East Bend with the Dayton Power and Light Company (DP&L). Duke Energy Kentucky now owns 100 percent of the station, having purchased DP&L's 31 percent interest in the station in 2014.

The station has river facilities to allow barge deliveries of coal and lime. East Bend is designed to burn eastern bituminous coal. The Company maintains a fuel reserve through an onsite coal pile and manages the inventory to maintain an approximate 45-day supply of coal. The Company currently maintains onsite lime inventory and manages the lime inventory to maintain an approximate 30-day supply.

Q. PLEASE SUMMARIZE THE MAJOR POLLUTION CONTROL EQUIPMENT AT EAST BEND.

A. The major pollution control features are a high-efficiency hot side electrostatic precipitator, a magnesium-enhanced lime (MEL) WFGD system to control sulfur dioxide (SO_2) emissions, and a selective catalytic reduction control (SCR) system designed to reduce nitrogen oxide (NO_x) emissions by 85 percent. The WFGD system was upgraded in 2005 to increase the SO_2 emissions removal to an average of 97 percent. The station's electrical output is directly connected to the Duke Energy Midwest (consisting of Kentucky and Ohio) 345 kilovolt (kV) transmission system.

[1] The nameplate ratings are the ratings provided by the manufacturer of the generating equipment. 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 net rating for East Bend is 600 MW.

Duke Energy Kentucky currently operates a landfill at East Bend (West Landfill cells 1 and 2) which is used for the storage and disposal of waste products resulting from the Company's WFGD system and other CCR material. Duke Energy Kentucky has completed closure of the East Landfill and the East Bend ash pond (Pond) and conversion of this Pond to a wastewater treatment system as was approved by the Commission previously. See Mr. Donnor's testimony for additional discussion of East Bend's environmental controls.

Q. PLEASE FURTHER DESCRIBE THE OPERATION OF EAST BEND'S WFGD TECHNOLOGY.

A. As I previously mentioned, East Bend's WFGD process relies upon MEL to control SO_2 emissions. The MEL WFGD scrubbing technology depends on a highly specialized version of quicklime containing a higher percentage of magnesium oxide which, when added to the absorber with the lime reagent, dissolves and facilitates high SO_2 removal efficiency.

Q. IS CONTINUING TO USE THE EXISTING MEL SCRUBBING PROCESS STILL COST EFFECTIVE AND, IN THE CUSTOMERS, BEST INTEREST?

A. No. Although this technology was reasonable and low-cost from an ongoing operations perspective at the time the unit was first constructed in the early 1980's, such is no longer the case. In the early 1980s, when the system at East Bend was designed and constructed, the cost of lime was modest; delivered prices were about $40/ton. This is no longer the case. The approximate lime cost at East Bend increased to [redacted]/ton in 2022, escalated to [redacted]/ton in 2023 and further increased to [redacted]/ton in 2024. The expenses associated with lime reagent, stabilization additives and disposal of the waste sludge produced by the process result in very high WFGD operating costs which, not only pass through directly to Customers; but adversely affect the competitiveness of the East Bend Station in today's power markets, impacting purchased power costs. Furthermore, recent issues with lime supply, quality, and price escalation pose additional risks to the East Bend Station from a reliability, compliance, and economic perspective. As a result of these risks, the Company believes now is the time to convert to the limestone-based reagent handling system.

Q. WHAT IS DRIVING THE NEED TO CONVERT TO A LIMESTONE-BASED REAGENT HANDLING SYSTEM?

A. Duke Energy Kentucky finds itself at a crossroads where maintaining the current system is adversely impacting the competitiveness of the station and presents a significant risk of further cost increases. This situation has developed due to a lack of a competitive market for the MEL product resulting in the Company needing to rely on [redacted]. These cost increases are becoming substantial for customers and are making East Bend less and less economic to run. MEL is a unique substance. The fuel security risk stemming from the scarcity of the MEL product possessing the correct chemical content required to continue operating the WFGD is placing the continued operation of the station at risk. If the Company cannot secure the necessary reagents to operate the WFGD, East Bend will be unable to comply with required environmental regulations and be forced offline temporarily for a significant period to retrofit the current system, or to shut down prematurely and most likely, permanently.

Q. WHAT IS THE DURATION OF THE COMPANY'S CURRENT LIME REAGENT CONTRACT?

A. The Company's current contract was executed through a public request for proposal (RFP) issued in 2023 for the MEL product. The solicitation was sent to eleven potential lime suppliers which included the major known producers of the product needed for East Bend Station. The Company received [redacted] bids for the requested and complying product. However, [redacted].[2] The Company reached an interim agreement with the remaining supplier, but at a price significantly higher than that of the prior contract. The supplier cited current market prices and demand from other industries, including steel production and lithium battery production, as the primary driver for its cost increases.

While that RFP initially solicited a two-year agreement, which the Company has successfully operated under for decades, the RFP contained additional language[3] that expressly allows the Company the discretion to expand that the two-year term, and that the RFP was meant to establish an opening basis for negotiations for price, terms, and conditions for the supply. In other words, the RFP made clear that the two-year term was by no means an absolute term limitation.

[redacted]

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[2] Staff-DR-01-022 Confidential Response (provided Sept. 6, 2024)
[3] Sierra-DR-01-007(a) Confidential Attachment 1 (provided Oct. 4, 2024)

[redacted]

Duke Energy Kentucky made continuous attempts to negotiate more competitive pricing structures including alternative contract lengths following its last RFP.

With little bargaining leverage against the [redacted] and a need to maintain the MEL supply for East Bend's continued operation, the Company was unsuccessful in its initial negotiations.

Q. IS THE QUOTED PROVISION TYPICAL FOR COMPANY RFPS FOR FUEL AND REAGENT SUPPLY?

A. Yes. Provisions like this are typical and part of good utility practice. My team of experts includes multiple individuals whose job it is to secure fuel and reagent supplies for numerous generating assets for Duke Energy affiliated utilities in North and South Carolina, Florida, Kentucky, and Indiana. These RFPs are not the final contract term, but rather provide the basis for the beginning of contract negotiations with the winning suppliers. My team uses their best efforts to obtain the most reasonable pricing terms and conditions, including contract length that is possible, without over committing the utilities to volumes that are unreasonable and could result in uneconomic operations or oversupply. I can say, unequivocally, that our procurement practices, including the terms in RFPs are designed to procure reasonable-priced and reliable supplies for these necessary commodities in a way that protects customers and our generation assets by ensuring procurement meets the technical and chemical requirements needed for the specific generating units.

Q. HAS THE COMPANY EXPLORED A LONG-TERM CONTRACT WITH THE SUPPLIER?

A. Yes. While initially, the supplier was not willing to enter into a long-term contract that extended beyond two years, after the Company first filed its CPCN Application on July 25, 2024, in Case No. 2024-00152, seeking to convert East Bend's WFGD to a Limestone-based handling system, the current MEL supplier approached the Company to discuss the potential for a longer-term contract at more favorable pricing. It was only after the MEL supplier learned of the Company's Application to convert to a Limestone based WFGD process, and the possibility of more suppliers, greater competition, and the loss of a buyer for its existing MEL product that this supplier became willing to consider alternatives terms and pricing. In other words, only through exercising our leverage to move away from the MEL product was the Company able to bring the supplier back to the table.

Q. PLEASE FURTHER EXPLAIN THE SUBSEQUENT DISCUSSIONS WITH THE SUPPLIER.

A. In early September 2024, the current MEL supplier became aware of the Company's then pending CPCN application to convert to a limestone-based reagent handling process and contacted the Company, indicating that it was now willing to consider the possibility of a longer-term MEL supply contract and potentially more competitive pricing options. As a prudent operator, it was in the best interest of customers to reopen discussions. Between mid-September into October, my team met with the supplier to discuss potential contract terms as both alternatives to, or in conjunction with, a limestone conversion if approved by the Commission.

Q. WHAT IS THE CURRENT CONTRACT OFFER?

A. These secondary negotiations have resulted in an agreement in principle between Duke Energy Kentucky and its MEL supplier on a [redacted] If the Company does receive approval, an alternative term of the contract through completion of the conversion project at current contract pricing escalating at 7% annually has also been negotiated as part of this agreement.

Q. IS IT REASONABLE FOR THE COMPANY TO CONTINUE TO OPERATE EAST BEND AS IS WITH THE CURRENT MEL LIME-BASED WFGD PROCESS?

A. No. It is neither reasonable, nor in the best interests of customers. There remains a significant fuel security and scarcity risk with exposure to a [redacted] The lack of a functioning competitive market for the MEL product places the Company at a significant disadvantage in its pricing negotiations and the economics of East Bend are suffering. Extending a higher cost reagent strategy will not help East Bend's position in the energy markets and will likely continue to adversely affect its economics and dispatchability going forward, resulting in additional customer costs. As the capacity factor of East Bend deteriorates, customers will be more exposed to purchased power, while continuing to pay for East Bend to sit idle. As I discuss below, the proposed Limestone Conversion project provides a lower cost solution to the significant risks posed by remaining tied to the current MEL WFGD process and is in customers best interest over the long term.

Q. DOES THE AVAILABLITY OF A LOWER PRICED LIME SUPPLY CONTRACT THAT IS GREATER THAN 24 MONTHS IN LENGTH ELIMINATE OR MITIGATE THE NEED FOR THE LIMESTONE CONVERSION?

A. No. Duke Energy Kentucky recognizes the value of and has reached an agreement in principle, to execute a lower cost contract greater than 24 months in length if the Commission were to deny the Application. However, the Company believes that a [redacted] agreement may not adequately protect customers from the risks that prompted the CPCN filing. This [redacted] MEL contract does not negate the continued fuel security risk stemming from the scarcity of the MEL product required to operate the WFGD. Additionally, customers remain at risk for future, and potentially significant price escalations due to a potential lack of a competitive market when the agreement comes up for renewal. If this supplier were to cease operations for any reason, and no alternative MEL supplies were available, East

Bend is still at risk for not being able to operate in compliance with existing environmental regulations and would be forced to shut down. This would mean the Company would have to rely upon the PJM market to procure energy and capacity to serve its customers until it could acquire or construct replacement generation or convert to a limestone based WFGD process.

Q. PLEASE DESCRIBE DUKE ENERGY KENTUCKY'S PROPOSAL TO CONVERT ITS LIME-BASED SCRUBBING SYSTEM TO A LIMESTONE BASED HANDLING SYSTEM IN THIS PROCEEDING.

A. In response to these significant risks Duke Energy Kentucky's engineers developed a project to convert the existing system to use a more widely available limestone reagent. A conversion to a limestone reagent WFGD process will result in greater supply resources and lower reagent costs, which in turn will result in a lower total dispatch cost for East Bend resulting in an increased capacity factor, as discussed in my testimony below.

Q. PLEASE PROVIDE A SUMMARY OF THE LIMESTONE CONVERSION PROCESS.

A. As more fully explained by Company witness Chad Donner, the Limestone Conversion Project scope includes modifications to existing equipment and is based on the turnkey delivery, including engineering, procurement, and construction. The conversion of the East Bend WFGD system to a lower-cost limestone reagent in an inhibited oxidation process (LSIO) operation involves several process, equipment, and system changes as Mr. Donner describes in greater detail.

Q. HOW DID THE COMPANY ARRIVE AT THE CONCLUSION TO CONSTRUCT THE LIMESTONE CONVERSION?

A. Duke Energy Kentucky has been examining the possibility of a change to the MEL WFGD process for some time. However, given the cost of the investment, its complexity, and the accessibility of lime reagent, it previously did not make clear economic sense for customers. The Company carefully evaluates its capital investments for all of its assets to make sure the money being spent is being put to good use for the benefit of customers, that the potential operational risks can be appropriately mitigated, and that it is a prudent investment.

It is only in the recent years that the MEL reagent costs have climbed exponentially, and supply became a concern. When the Company was faced with the availability of [redacted] after the 2023 RFP solicitation, and after exploring additional options for continuing the lime-based process, a decision was made to pursue the Limestone Conversion. Given the likelihood that this investment, while significant, will not only address the risks of: 1) fuel security with a [redacted] of the reagent; 2) unit economics in the market; 3) reduced capacity factors; and 4) environmental non-compliance; the Company believes it is both a reasonable and prudent decision to undertake the conversion at this time.

Q. IS THE LIMESTONE CONVERSION PROJECT THE MOST ECONOMIC AND REASONABLE SOLUTION FOR CUSTOMERS? PLEASE EXPLAIN.

A. Yes. As I explain below, the alternatives to the Limestone Conversion Project are not practical and are estimated to be more expensive and risky alternatives. Further, not completing the Limestone Conversion Project creates an uncertain but quantifiable significant risk for customers should the current MEL product become unavailable. Even ignoring the projected on-going customer commodity and purchase power cost savings, the Limestone Conversion Project is the most economic and reasonable solution for Duke Energy Kentucky's customers based on a total project cost of $125.8 million. This project cost also includes upgrades to East Bend's WFGD that would also allow the Company to respond to and comply with recently effective updates to the Mercury Air Toxics Standards (MATS) that became effective in April 2024.

Q. PLEASE EXPLAIN HOW THIS LIMESTONE CONVERSION IS THE LEAST COST, MOST REASONABLE SOLUTION FOR COMPLIANCE?

A. As an initial matter, the project costs should be considered against the risk of approximately $166.1 million in potential penalties, capacity and energy replacement costs, and lost margins should East Bend become unavailable and inoperable due to a lack of reagents should the Company maintain its status as a Fixed Resource Requirement (FRR) participant in the PJM Interconnection LLC (PJM) Reliability Pricing Model (RPM) construct.[4] If the station becomes unable to comply with environmental regulations, the plant cannot be operated and therefore unusable as a supply resource for customers, or to satisfy the Company's FRR plan. In such a situation, the Company would face capacity replacement costs

[4] As an FRR participant, Duke Energy Kentucky currently relies upon its owned generation as the unit-specific capacity withing its delivery zone to satisfy its load obligations, including reserves, as part of its "FRR Plan."

and deficiency penalties related to its FRR Plan, as well as additional replacement energy costs over a three-year period unless and until the Company can complete its transition to participation in PJM's Base Residual Auction (BRA) and Incremental Auction constructs (IA).[5] While an FRR, unless and until the Company replaces those lost MWs of unit-specific capacity through either acquiring or constructing new base-load generation or can then make necessary investments to reinstate East Bend (assuming it is still a viable alternative given East Bend's age, other pending environmental regulations and useful life), customers will remain unhedged against the wholesale capacity and energy markets. This means there are no sales to offset the costs of participating in the wholesale capacity and energy markets.

Q. PLEASE FURTHER EXPLAIN THE FRR PENALTY COST, REPLACEMENT CAPACITY COSTS, AND REPLACEMENT ENERGY COSTS.

A. As stated, in the hypothetical situation that as an FRR participant, East Bend were to become immediately unable to operate due to lack of availability of the MEL product, the Company would have to shut down the unit and attempt to replace it with unit-specific capacity in the Company's PJM delivery zone (with uncertainty regarding availability of such capacity) and would be subject to the FRR plan

[5] To make such a transition, the Company acknowledges that it must first receive Commission approval. Such a transition must occur so to align with the PJM delivery years that run June 1st through May 30th the following year. The annual BRA procure capacity for the delivery three years into the future. So any transition would require a three-year minimum transition term providing the Company can receive authorization to align with PJM notice requirements that are typically two months prior to the BRA.

deficiency penalty until the Company is able to transition to full participation in the RPM's BRA and IA constructs.[6]

Even assuming it is still economically possible to bring back East Bend and pursue the Limestone Conversion in the future, such a conversion will still take time to complete, exposing customers to more unmitigated wholesale market costs. It is estimated that for the approximate three-year period necessary to then complete the limestone conversion project, from the start of the CPCN process to project completion, the Company would be deficient by approximately 500 MW a year, equal to the 600 MW East Bend rating multiplied by the unit's 0.84 Effective Load Carrying Capability (ELCC) value.

Using this three-year project timeline, the total capacity and energy impact over the three-year period is $166.1 million. Of this amount, the capacity-related deficiency penalty (first year impact) and estimated replacement capacity costs (second- and third-year impact) is approximately $118.8 million.

During the first PJM Delivery Year that the unit is unavailable, and replacement unit-specific capacity cannot be found, Duke Energy Kentucky would incur a FRR Deficiency Penalty equal to the shortfall amount multiplied by the greater of either the Gross Cost of New Entry (CONE) or 1.75 multiplied by Net CONE. Using the current Gross CONE of $444.26/MW-Day (UCAP Price) since it is currently the greater, the estimated penalty for the first PJM Delivery Year would be $82 million.[7] For the second and third year capacity impacts, assuming

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[6] As part of the risk of FRR deficiency, PJM could force the Company to exit the FRR altogether and into the auction construct.

[7] Penalty = 600 MW x .84 (ELCC Class Rating) x $444.26/MW-Day x 365 days

that Duke Energy Kentucky would no longer be able to retain its FRR status and must commence participating in the RPM auction construct was estimated at $18.4 million[8] per year. This was calculated by using the current bi-lateral market price for capacity of $80/MW-Day and escalating to $100/MW-Day to represent the capacity market during this time as a determinant to calculate the resulting replacement capacity purchase. Thus, the three-year capacity impact total is $82 million plus $18.4 million plus $18.4 million, or $118.8 million.

For the energy market impact, if East Bend is unable to operate during these three years, the unit would forgo margin (value) in the PJM Energy and Ancillary Services Market. Although this amount can change significantly from year to year, for this estimation it was assumed that the unit was $5/MWh "in the money" on average to operate and had a 60% net capacity factor. The resulting energy impact is $15.8 million[9] per year, or $47.3 million over the three-year period. Summing the $47.3 million energy market impact and the $118.8 million capacity market impact totals to the total impact of $166.1 million.

The ability to have a generating unit that can provide sales into the wholesale energy, capacity and ASM markets is a benefit to Duke Energy Kentucky's customers. Even in a scenario where the Company had already transitioned away from the FRR participation to the full BRA/IA capacity procurement construct, under a forced shut down due to an inability to comply with environmental regulations scenario, customers are left without any offsetting wholesale electric market revenues as a hedge against the costs.

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[8] Replacement Capacity = 600 MW x .84 (ELCC Class Rating) x $100/MW-Day x 365 days
[9] Replacement Energy = 600 MW x .60 (Net Capacity Factor) x $5/MWh x 8760 hours

Finally, as discussed below and not included in the $166.1 million impact above, the project saves $3.8 million in fuel and purchase power costs, $11.3 million in reagent costs, and $1.0 million in additional non-native off-system sales margin on average per year.

Q. HAS THE COMPANY PERFORMED ANY MODELING TO DEMONSTRATE THAT THE CONVERSION TO A LIMESTONE REAGENT PROCESS WILL IMPROVE THE ECONOMICS OF EAST BEND? PLEASE EXPLAIN.

A. Stochastic production cost modeling shows that conversion to a limestone reagent process is economic in future scenarios. With the change in commercial in-service date to June 2027, the economic benefits of the project in 2027 are offset by higher reagent and purchase power costs in the first half of 2027 for a net benefit of approximately $1.3 million in positive impacts to customers. Looking at 2028 and 2029, the total forecasted dispatch cost of East Bend is reduced by 18% or $7.16/MWh when operating on limestone, from the forecasted dispatch cost of $39.63/MWh when operating on the proposed lower-cost MEL product in the no conversion case. The reduction in dispatch costs results in increased economic dispatch of East Bend into the PJM market and reduced reliance on PJM resources to serve customer demand.

Comparisons of production cost modeling of the two scenarios show on average a 19% increase in capacity factor in the limestone scenario for the 2028 through 2029 period, which translates to total average additional generation in the limestone case of ~700 GWh over the two-year period. The cost to serve the Duke

Energy Kentucky customer load continues to be reduced by an annual average amount of $3.8 million per year in fuel and purchase power, and $11.3 million in reagent costs from 2028 through 2029, with an additional annual average of approximately $1.0 million of non-native off-system sales margin in the same period, for a total annual savings of $16.1 million per year. The system average fuel rate (exclusive of reagents) in the 2028 through 2029 period is projected to decline $0.91/MWh annually, primarily due to the continued reduction in PJM purchase volumes. See Confidential Attachment JAV-2 for the detailed model results. The Company's analysis was conducted using the PowerSimm stochastic modeling software as this is the same model used by the Company to forecast East Bend's position and costs over the mid-term planning horizon i.e., next month through the next five years. Therefore, the Company found it to be the most reasonable model to use in evaluating the alternative impacts to the Company's FAC and ESM on a similar five-year time horizon.

Q. DID THE COMPANY EXPLORE AND EVALUATE ANY ALTERNATIVE STRATEGIES TO THE LIMESTONE CONVERSION PROJECT? PLEASE EXPLAIN.

A. Yes. The Company has negotiated a multi-year contract with the MEL supplier, that while reducing costs in the short term for customers, maintains the supply and significant price escalations in years beyond the contract scope term. This contract will not last through the anticipated life of East Bend as a coal-burning unit, placing the Company in the same weak bargaining position in a few short years. Moreover, the long-term contract strategy would not mitigate the risks [redacted]

[redacted] if the supplier experienced a mining disruption or shut down mine operations. If supply became unavailable, Duke Energy Kentucky would be in the untenable position of being unable to operate the MEL WFGD forcing a station shutdown and relying solely upon the PJM market to serve customers, exposing them to volatile energy prices.

The Company also considered a process where a standard high calcium quicklime product was procured and mixed on-site with a magnesium hydroxide slurry to derive the correct chemical composition necessary to continue operating the existing WFGD process. That strategy was determined unreasonable in several respects. The ongoing operations and maintenance reagent expense would be significant. The Company would need to contract for both magnesium hydroxide and high calcium quicklime increasing overall reagent costs. Importantly, due to the increasing demand for alternative use, domestic high calcium quicklime supply is also severely constrained. In fact, during the 2023 RFP, high calcium quicklime quotes were specifically requested for East Bend[10]; and no high calcium quicklime capacity was offered. Finally, the Company would have to truck in the magnesium hydroxide daily to produce the correct WFGD reagent composition. These additional costs would only worsen the economics of the station, as opposed to the Limestone Conversion Project that is projected to actually improve its economics. Additionally, the onsite mixing strategy does not mitigate or alleviate the reagent scarcity risk like the Limestone Conversion Project does, thereby exposing the

[10] SIERRA-DR-01-007(a) Confidential Attachment 1 (provided Oct. 4, 2024)

Company and customers to the same non-compliance risks if the product becomes unavailable.

Q. PLEASE PROVIDE A COMPARISON SHOWING WHY WERE THOSE ALTERNATIVES UNREASONABLE FROM A COST PERSPECTIVE AS COMPARED TO THE LIMESTONE CONVERSION?

A. As discussed above there were only two alternative options to consider. The first, maintaining the status quo of short-term MEL supply contracts that would, result at best, in no change in the Company's current lime reagent cost detailed above. However, the more likely status quo scenario would be that customers and the Company would be at increased risk for continued escalation in reagent costs while continuing to be 100% exposed to the risk of [redacted] to meet East Bend's MEL WFGD specification needs.

The second, involving the mixing of standard high calcium quicklime and magnesium hydroxide onsite to deliver the desired chemistry for proper WFGD operation would result in higher reagent costs further increasing the uneconomic impacts to East Bend's dispatch. The Company was unable to calculate the additional dollar/ton cost of the necessary high calcium quicklime [redacted]

[redacted]. Compared to the discussed alternatives, the Limestone Conversion Project provides a benefit to customers of approximately $11.3 million in annual average reagent savings while mitigating the identified risks.

Q. PLEASE DESCRIBE THE RECENT HISTORIC AND CURRENT ECONOMICS OF EAST BEND.

A. East Bend provides value through PJM's energy, capacity, and ancillary service markets. The immediate value of East Bend's existing capacity lies in an increasingly constrained PJM capacity market. PJM currently projects scenarios that have severely inadequate reserve margins by 2030,[11] this would indicate an increasing value for East Bend capacity during the period analyzed in the CPNC analysis. For example, the 2025/2026 PJM Base Residual Auction (BRA) cleared at $269.92/MW-Day, the highest cleared value in PJM history[12], while the current bilaterial capacity price of future auctions is approximately $250/MW-Day or an approximate value [redacted] The table below depicts the value of East Bend over the last six and a half years.

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[11] https://www.pjm.com/-/media/library/reports-notices/special-reports/2023/energy-transition-in-pjm-resource-retirements-replacements-and-risks.ashx

[12] https://pjm.com/-/media/markets-ops/rpm/rpm-auction-info/2025-2026/2025-2026-base-residual-auction-report.ashx

Table 1

	Energy Market Revenue	Ancillary Services Revenue	Capacity Revenue	Total Operating Revenue	Fuel Cost	Total O&M Cost (East Bend Coal)	Expense (Excluding Depreciation & Amortization)	Estimated Capacity Value at BRA Cleared Capacity Price	Net Operating Revenue
2018	89,368,124.81	3,436,491.00	2,026,798.00	94,831,413.81	57,890,072.98	58,525,293.48	116,415,366.46	29,332,753.54	7,748,800.89
2019	80,764,631.29	2,592,872.00	-	83,357,503.29	67,767,903.48	50,360,969.13	118,128,872.61	25,492,740.63	(9,278,628.69)
2020	51,214,367.96	2,576,568.00	-	53,790,935.96	50,256,154.57	47,008,575.71	97,264,730.28	23,588,125.00	(19,885,669.32)
2021	83,491,680.95	2,651,276.00	-	86,142,956.95	54,171,470.37	50,281,245.75	104,452,716.12	27,268,541.67	8,958,782.50
2022	203,779,804.00	3,322,283.00	1,537,235.00	208,639,322.00	79,902,242.78	46,528,829.57	126,431,072.35	20,105,614.38	102,313,864.03
2023	70,944,881.48	2,562,808.00	1,300,148.00	74,807,837.48	85,370,908.00	47,434,646.17	132,805,554.17	9,993,335.00	(48,004,381.69)
YTD 2024	49,872,146.87	1,614,514.00	153,040.00	51,639,700.87	53,561,266.98	29,905,586.58	83,466,853.56	4,464,847.29	(27,362,305.40)
	629,435,637.36	18,756,812.00	5,017,221.00	653,209,670.36	448,920,019.16	330,045,146.40	778,965,165.56	140,245,957.51	14,490,462.31

The Company's IRP analysis includes a robust analysis of different scenarios forecasted over a long-term planning horizon in reaching a plan that best serves its customers' future energy and capacity needs in a reliable and cost-effective manner.

Q. YOU PREVIOSULY STATED THAT THIS LIMESTONE CONVERSION PROJECT SHOULD IMPROVE THE ECONOMICS AND CAPACITY FACTOR OF EAST BEND. PLEASE EXPLAIN AND QUANTIFY THOSE ANTICIPATED IMPROVEMENTS.

A. Comparisons of stochastic production cost modeling of the two scenarios show on average a 19% increase in capacity factor in the limestone scenario for the 2028 through 2029 period, with relative benefit increasing over time due to escalating quicklime costs (and subsequent reduction in dispatch) in the no action scenario. This translates to total average additional generation in the limestone case of ~700 GWh over the two-year period. The cost to serve the Duke Energy Kentucky customer load is reduced by an annual average amount of $3.8 million per year in fuel and purchase power, and $11.3 million in reagent costs from 2028 through 2029, with an additional approximate $1.0 million of annual average non-native off-system sales margin in the same period, for a total annual average savings of $16.1 million per year.

Q. WILL THE LIMESTONE CONVERSION HAVE ANY POSITIVE IMPACTS TO THE COMPANY'S FUEL ADJUSTMENT CLAUSE? PLEASE EXPLAIN.

A. Yes. The system average fuel rate (exclusive of reagents) in the 2028 through 2029 period is projected to decline $0.91/MWh annually, due largely to the reduction in higher cost PJM purchase volumes.

Q. WILL THE LIMESTONE CONVERSION HAVE A POSITIVE IMPACT TO THE COMPANY'S OFF SYSTEM SALES MECHANISM, RIDER PSM? PLEASE EXPLAIN.

A. Yes. Under the limestone conversion scenario, modeled off system sales in the 2028 through 2029 period see a net increase of 221 GWhs. As discussed above, this results in an average increase of approximately $1.0 million per year in net revenue from off system sales.

Q. WHAT IS THE PROPOSED CONSTRUCTION TIMING FOR THE LIMESTONE CONVERSION PROJECT?

A. The Company is anticipating 18 months to complete the construction once the Company receives approval. As depicted in Exhibit 4, sponsored by Witness Donner, the Company now anticipates construction commencing by mid-2026 with a project completion and operation commencing by Spring 2027, in advance of the new MATS update compliance deadline. If the Company receives Commission approval of this CPCN, by June 30, 2025, the Company will have sufficient time to procure the necessary long-lead-time equipment and secure the resources to complete the project in time for MATS compliance. The MATS compliance deadline of July 2027 is the key driver for the in-service date for this project.

Q. IS THE CONSTRUCTION OF THE LIMESTONE CONVERSION PROJECT EXPECTED TO ADVERSELY IMPACT THE OPERATION OF EAST BEND?

A. No. In the short term, the Company will perform the construction activities while East Bend continues to operate under the existing MEL WFGD process. As Mr. Donner explains in his direct testimony, a 10–12-week outage will be needed to complete the project and place it into commercial operation. With timely approval, the Company would expect to have East Bend back online and operating before summer 2027 season.

In the long-term, it is the Company's belief that the Limestone Conversion Project will result in an overall lower reagent expense for customers going forward and improve the economics of the station in the wholesale energy markets thereby positively impacting East Bend's operations. The life of the station will be driven by environmental regulations and other factors beyond the scope of this project. However, it is safe to say that not constructing the project will very likely cause the station to cease operation significantly earlier than even what the Company's current and prior, 2021 Integrated Resource Plan modeling showed. Absent this project, the economics of the station will continue to get worse as the costs of reagents continue to rise. And if the [redacted] decides to cease operation, then the Company would be without any source of MEL supply forcing the station to cease operations.

Q. HAS THE COMPANY PROACTIVELY EXPLORED ALTERNATIVE MEL SOLUTIONS?

A. In Q1 2020, Duke Energy Kentucky's MEL supplier did provide the Company notice of the operational suspension of its MEL mining operation due to a lack of industry demand for the MEL product. At the same time, the supplier made the commitment to honor its contractual obligations from an alternative affiliated mine. However, due to the chemical composition of the lime from the alternative mine it did require additional chemical processing to meet East Bend's WFGD system specifications. Duke Energy Kentucky previously provided the Commission an overview of these issues in prior proceedings, including its Environmental Surcharge Report filed in November 2020.[13] Duke Energy Kentucky received official notification of operations at the suppliers MEL mining operation recommencing in January 2022.

As a result of the suspension in operations, Duke Energy Kentucky has since tested the only other known alternative source of the MEL product as well as tested alternative chemical additives to quicklime to increase potential supply sources to meet environmental requirements. This testing informed the Company's Alternative 3 - On-Site mixing of a Mag-Lime product outlined in the Application.

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[13] *See e.g., In re An Electronic Examination By The Public Service Commission Of The Environmental Surcharge Mechanism Of Duke Energy Kentucky, Inc. For The Six-Month Billing Periods Ending November 30, 2020, May 31, 2021, November 30, 2021, November 30, 2022, And May 31, 2023, And The Two-Year Billing Periods Ending May 31, 2020, And May 31, 2022,* Case No. 2023-00374, Response to STAFF-DR-01-001 Attachment 34 (January 31, 2024); *See also,* Duke Energy Kentucky Environmental Surcharge Report for October 2020, submitted to the Commission November 20, 2020.

Duke Energy Kentucky has received reliable supply and competitive pricing on its lime supply agreements from the current supplier since the 1980's. While Duke Energy Kentucky was aware that inflation was putting upward pressure on commodity prices and that there were limited alternatives for the MEL product it was not until the results of the 2023 RFP were received that the extraordinary MEL product price increase and its impact on East Bend's economic dispatch profile was fully made apparent. Additionally, up and to the point the [redacted], Duke Energy Kentucky had a reasonable expectation of an alternative supply being available.

Q. IS IT POSSIBLE FOR THE COMPANY TO ENTER INTO THE PROPOSED LONGER TERM MEL AGREEMENT AND FILE ITS CPCN TO CONVERT TO LIMESTONE WFGD AT A LATER DATE IF NECESSARY?

A. This delay is not a reasonable option for several reasons. First, should the CPCN be denied, the Company is left without a path for MATS compliance effective July 2027. The Company would still need to perform WFGD upgrades and retrofits to ensure MATS compliance for East Bend to remain operational. This is a significant co-benefit of the limestone conversion.

Second, the Commission must consider the age of East Bend and its likely remaining operational life. Based upon current environmental regulations, and as discussed in the Company's IRP, the most recent update to the Clean Air Act dictates that East Bend must retire or convert to natural gas co-firing (dual fuel) or full natural gas burning by 2030. And under a dual fuel (coal and natural gas cofiring) scenario, East Bend would still have to retire by the end of 2038. Finally, the cost of the Limestone Conversion is likely to increase in the future due to supply chain tightening, construction costs and simple inflation. These three factors, additional new environmental regulations, approaching unit end of life and construction cost increases would make a Limestone Conversion a potentially more costly strategy for customers five years from now. The rate impact to customers five years from now could be significant as there would be fewer years over which to spread the cost of the project for customers.

Lastly, as Mr. Gagnon explains, the Company's recent IRP shows that a full conversion of East Bend to natural gas results in unreasonable risks to customers, in the form of increasing energy market exposure as the plant's dispatch costs would increase, making it less economic in the PJM energy market.

Q. WHAT IS THE FULLY LOADED ESTIMATED COST OF CONSTRUCTION AND ONGOING OPERATION?

A. As explained by Mr. Donner, The fully loaded estimated cost of construction (with material, engineering, internal and external labor, contingency, and escalation) for the project is approximately $125.8 million. The non-fuel incremental cost of operation is estimated to be less than $10,000 per year.

III. DUKE ENERGY KENTUCKY'S ENVIRONMENTAL COMPLIANCE PLAN AND ENVIRONMENTAL SURCHARGE MECHANISM

Q. PLEASE EXPLAIN HOW DUKE ENERGY KENTUCKY PROPOSES TO FINANCE THE CONSTRUCTION OF THE LIMESTONE CONVERSION PROJECT?

A. Company witness Sarah Lawler explains in her direct testimony that the Company is seeking to recover the costs of constructing, operating, and maintaining this project through its ESM.

Q. PLEASE IDENTIFY THE PROJECTS CURRENTLY IN DUKE ENERGY KENTUCKY'S ENVIRONMENTAL COMPLIANCE PLAN AND RECOVERED THROUGH ITS ESM?

A. Attachment JAV-1 is a summary of the Company's ECP. The Company's Environmental Compliance Plan projects are as follows:

1. Project EB020290 Lined Retention Basin West;
2. Project EB020745 Lined Retention Basin East;
3. Project EB020298 East Bend SW/PW Reroute;
4. ARO amortization for Pond Closure;
5. Project EB021281 East Bend Landfill Cell 2;
6. ARO for East Landfill Closure;
7. ARO for West Landfill Ongoing Maintenance; and
8. Emission allowance inventories and expenses and reagent expenses.

Projects EB020290, EB0202745, and EB020298 (collectively the Ash Pond Projects) are interrelated and are for the closure and repurposing of the ash pond at East Bend and the associated water redirection necessary in response to the CCR Final Rule and the ELG Final Rule as well as various Kentucky groundwater regulations. Project EB021281 is for the construction of Cell 2 of the West Landfill. ARO for East Landfill Closure is for the construction activities necessary for the closure of the East Landfill and post closure activities including oversite for groundwater monitoring, mowing, maintenance, and upkeep of the landfill slopes. ARO for West Landfill Ongoing Maintenance is for ongoing maintenance related to ongoing environmental compliance at the West Landfill.

Q. WHAT RELIEF IS DUKE ENERGY KENTUCKY SEEKING IN THIS PROCEEDING FOR ITS ECP?

A. Duke Energy Kentucky is seeking authorization to amend its ECP to include the construction and ongoing operation activities necessary for the Limestone Conversion Project and to amend its ESM to allow recovery of the costs of construction and ongoing operations and maintenance, including the reagents. Ms. Lawler explains the expected impact of the requested changes to the ECP on customer bills.

Q. IS THE LIMESTONE CONVERSION PROJECT NECESSARY FOR COMPLYING WITH THE FEDERAL CLEAN AIR ACT, AND THOSE FEDERAL STATE, OR LOCAL ENVIRONMENTAL REGULATIONS WHICH APPLY TO COAL COMBUSTION WASTES AND BY-PRODUCTS FROM FACILITIES UTILIZED FOR THE PRODUCTION OF ENERGY?

A. Yes. As Mr. Geers explains in his direct testimony, this project is needed to continue complying with existing environmental regulations impacting the generation of electricity by East Bend, a coal-fired generating station. The conversion is necessary to enable the plant to continue to economically comply with existing environmental regulations and the associated upgrades will also enable

East Bend to meet the newly effective MATs standard while effectively lowering on-going reagent operating expenses.

IV. CONCLUSION

Q. WERE ATTACHMENTS JAV-1 AND JAV-2 PREPARED BY YOU OR AT YOUR REQUEST AND UNDER YOUR DIRECTION AND CONTROL?

A. Yes.

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

A. Yes.

VERIFICATION

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

The undersigned, John A. Verderame, Vice President, Fuels & Systems Optimization, being duly sworn, deposes and says that he has personal knowledge of the matters set forth in the foregoing testimony, and that the information contained therein is true and correct to the best of his knowledge, information, and belief.

John A. Verderame, Affiant

Subscribed and sworn to before me by John A. Verderame on this 23rd day of January, 2025.

NOTARY PUBLIC

My Commission Expires: 3/26/2027

KARA LYNNE LUKEHART
NOTARY PUBLIC
LINCOLN COUNTY, NC
My COMMISSION EXPIRES 3/26/27

Duke Energy Kentucky, Inc.
Environmental Compliance Plan

Project #	Project Description	Air Pollutant or Waste/Byproduct to be controlled	Control Facility	Generating Station	Environmental Regulation	Environmental Permits[1]	Scheduled Completion	Actual (A) or Est. (E) Projected Capital Cost ($Million)
1.	EB020290 Lined Retention Basin West;	Bottom Ash	CCR/ELG	East Bend	EPA CCR and ELG Final Rules	Division of Surface Water, KPDES Permit #0040444 Dam Safety Permit from Division of Surface Water listed (Stream Construction Permit), Permit No. **26395P**	November 2018	$10(A)
2.	EB020745 Lined Retention Basin East;	Bottom Ash	CCR/ELG	East Bend	EPA CCR and ELG Final Rules	Division of Surface Water, KPDES Permit #0040444 Dam Safety Permit from Division of Surface Water listed (Stream Construction Permit), Permit No. **26395P**	2021	$10(A)
3.	EB020298 East Bend SW/PW Reroute; and	Bottom Ash, misc., CCR runoff	CCR/ELG KY groundwater regulations	East Bend	EPA CCR and ELG Final Rules, KPDES	KDWM, Permit number SW00800006, KDEP Division of Surface Water, KPDES Permit #0040444	2020	$30 (A)
4.	ARO for Pond Closure;	Bottom Ash	CCR/ELG, KY Ground water regulations	East Bend	EPA CCR and ELG Final Rules and KPDES	KDEP Division of Waste Management concurrence for clean closure.	2021	$28 (A)
5.	EB021281 East Bend Landfill Cell 2;	Bottom Ash, FGD, Fly Ash	CCR/KY CCR regulations	East Bend	EPA CCR and ELG Final Rules and KPDES, KY CCR Regulations	KDWM, Permit number SW00800006, KDEP	2020	$17 (A)
6.	ARO for East Landfill Closure;	East Landfill Closure	CCR, KY groundwater regulations applicable to coal combustion	East Bend	EPA CCR Final Rules and KY CCR Regulations	KDWM, Permit number SW00800006, KDEP	2023	$16 (A)
7.	ARO for West Landfill Ongoing Maintenance;	West Landfill Routine Maintenance, Groundwater and Well Monitoring Costs	CCR, KY groundwater regulations	East Bend			Ongoing	N/A

[1] Permits filed with Commission in Case No. 2016-00398.

8.	Limestone Conversion;	SO_2, mercury	CSAPR, MATS	East Bend	CSAPR, MATS	East Bend Title V Permit V-12-023, Minor Permit Revision filed July 17, 2024	2026	$125.8 (E)
9.	Consumables (EAs Reagents, etc.)	SO_2, NOx, CO_2	CSAPR	East Bend	CSAPR	Est Bend Title V Permit V-12-023	Ongoing	N/A

Duke Energy Kentucky, Inc.

Environmental Compliance Plan

Project #	Project Description	Air Pollutant or Waste/Byproduct to be controlled	Control Facility	Generating Station	Estimated Annual O&M			
					2026	2027	2028	2029
1.	EB020290 Lined Retention Basin West	Bottom Ash	CCR/ELG	East Bend	$0 (E)	$0 (E)	$0 (E)	$0 (E)
2.	EB020745 Lined Retention Basin East	Bottom Ash	CCR/ELG	East Bend	$0 (E)	$0 (E)	$0 (E)	$0 (E)
3.	EB020298 East Bend SW/PW Reroute	Bottom Ash, misc., CCR runoff	CCR/ELG KY groundwater regulations	East Bend	$0 (E)	$0 (E)	$0 (E)	$0 (E)
4.	ARO for Pond Closure	Bottom Ash	CCR/ELG, KY Ground water regulations	East Bend	$0.1 (E)*	$0.1 (E)*	$0.1 (E)*	$0.1 (E)*
5.	EB021281 East Bend Landfill Cell 2	Bottom Ash, FGD, Fly Ash	CCR/ELG/KY CCR regulations	East Bend	$0 (E)	$0 (E)	$0 (E)	$0 (E)
6.	ARO for East Landfill Closure; and	East Landfill Closure	CCRKY Coal Combustion Residuals	East Bend	$0.5 (E)	$0.4 (E) **	$0.4 (E) **	$0.4 (E) **
7.	ARO for West Landfill Ongoing Maintenance; and,	West Landfill Routine Maintenance, Groundwater and Well Monitoring Costs	CCR, KY groundwater regulations	East Bend	$4.4 (E)	$4.2 (E)	$4.3 (E)	$4.2 (E)
8.	Limestone Conversion	SO_2, mercury	CSAPR, MATS	East Bend	$0 (E)	$0 (E)	$0 (E)	$0 (E)
9.	Consumables (Emission Allowances, Reagents, etc.)	SO_2, NOx, CO_2	CAIR	East Bend	$26 (E)	$9 (E)	$8 (E)	$9 (E)

*O&M estimates represent post-closure maintenance costs related to all four bottom ash projects listed above: EB020290, EB020745, EB020298 and the ARO for Pond Closure.

** O&M estimates represent post-closure maintenance costs related to the East Landfill closure.
*** O&M estimates represent on-going maintenance costs related to the Ash Maintenance, Groundwater, and Wells.

CONFIDENTIAL PROPRIETARY
TRADE SECRET

CONFIDENTIAL ATTACHMENT JAV-2

FILED UNDER SEAL