COMMONWEALTH OF KENTUCKY

BEFORE THE PUBLIC SERVICE COMMISSION

In the Matter of:

The 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. 2024-00152

PUBLIC DIRECT TESTIMONY OF

CHAD M. DONNER

ON BEHALF OF

DUKE ENERGY KENTUCKY, INC.

June 25, 2024

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I. INTRODUCTION

Q. PLEASE STATE YOUR NAME AND BUSINESS ADDRESS.

A. My name is Chad M. Donner and my business address is 139 E. 4th Street, Cincinnati, Ohio.

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

A. I am employed by Duke Energy Business Services LLC (DEBS) as Principal Engineer. DEBS provides various services to Duke Energy Kentucky, Inc., (Duke Energy Kentucky or the Company) and other affiliated companies of Duke Energy Corporation (Duke Energy Corp.).

Q. PLEASE BRIEFLY DESCRIBE YOUR EDUCATIONAL AND PROFESSIONAL BACKGROUNDS.

A. I graduated with a bachelor's degree in mechanical engineering from the University of Cincinnati and am currently a registered Professional Engineer in the State of Ohio (License# P.E. 79699). I have been employed by Duke Energy for 19 years and spent the first 7 years of my career working as an environmental equipment owner at the W.H. Zimmer Power Station. My responsibilities there included performance monitoring, operation & maintenance support, and capital project management for the environmental control equipment (SCR, DSI, ESP, WFGD). Following my time at Zimmer, I transitioned into a corporate environmental controls subject matter expert role where I provide similar expertise for the broader Duke Energy fleet. Along with my Duke Energy internal experience, I maintain involvement and sit on steering committees with multiple environmental controls

operations and maintenance (O&M) organizations as a recognized expert in the industry.

Q. PLEASE SUMMARIZE YOUR DUTIES AS A PRINCIPAL ENGINEER.

A. As a Principal Engineer and Principal Environmental Controls Subject Matter Expert, I provide technical support for Duke Energy's fleet of air pollution control equipment. This includes performance monitoring, operations and maintenance support, process optimization, and technical authority of air pollution control equipment.

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

A. No.

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

A. The purpose of my testimony is to support Duke Energy Kentucky’s request for a certificate of public convenience and necessity (CPCN) to convert the existing wet flue gas desulfurization (WFGD) at the East Bend Generating Station (East Bend) from a magnesium enhanced lime (MEL) based scrubbing process to a process that uses limestone as its reagent (Limestone Conversion Project). In doing so, my testimony provides detail on the design, cost, and construction activities necessary

to complete the Limestone Conversion Project. I also sponsor Exhibits 3 and 4 to the Company's Application.

II. DISCUSSION

Q. PLEASE PROVIDE A BRIEF OVERVIEW OF EAST BEND'S OPERATION AND ITS ENVIRONMENTAL CONTROLS.

A. East Bend is designed to burn low- to high-sulfur eastern bituminous coal. The major pollution control features include a mechanical draft cooling tower, a high-efficiency hot side electrostatic precipitator, a MEL based WFGD system, low nitrogen oxide ($NO_{x)}$ burners and a selective catalytic reduction control (SCR) system which is designed to reduce NO_x emissions by 85 percent. East Bend's WFGD process relies upon MEL to control sulfur dioxide ($SO_{2)}$ emissions. The WFGD system was upgraded in 2005 to increase SO_2 emissions removal capability to about 97 percent. The station electrical output is directly connected to Duke Energy's Midwest (consisting of Kentucky and Ohio) 345 kilovolt (kV) transmission system.

Q. WHAT IS THE PURPOSE OF THE COMPANY'S REQUEST IN THIS PROCEEDING?

A. Duke Energy Kentucky is seeking commission approval to convert the existing WFGD System, that currently relies upon a MEL-based reagent handling system to a system that is capable of using limestone, a more easily obtainable and lower cost reagent. The reason for this request is that the expenses associated with MEL reagent, stabilization additives and disposal of the waste sludge produced by the process result in very high WFGD operating costs which adversely affect the

competitiveness of the East Bend Station in today's power markets. 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, Duke Energy Kentucky approached AECOM to assess the technical feasibility of converting the WFGD system to use lower-cost limestone reagent in an inhibited oxidation process (LSIO) while still meeting all environmental and reliability requirements, and whether the required capital investment is economically justified.

Q. PLEASE BRIEFLY EXPLAIN WHY THE COMPANY NEEDS TO CONSTRUCT THE LIMESTONE CONVERSION PROJECT.

A. Mr. Verderame explains and supports the need for the Limestone Conversion Project in his direct testimony. In short, the project is necessary to address the risks of environmental non-compliance, premature unit shutdown, and mitigate the increased risks of substantial price increases and unavailability of the existing MEL product.

As supported by Company witness Mr. Geers, the conversion to a limestone scrubbing process will allow the Company to continue to meet existing environmental regulations, and as Mr. Verderame describes, at a lower projected cost for customers that should improve the economics of the station in the competitive wholesale electric markets in PJM Interconnection LLC (PJM).

Q. PLEASE DESCRIBE THE COMPANY'S CONSTRUCTION PLAN FOR THE LIMESTONE CONVERSION PROJECT.

A. The construction is anticipated to commence in late 2025 with pre-construction activities commencing in early 2025, upon Commission approval of this application. The Company recently completed the preliminary engineering and design of the Limestone Conversion Project, included as Exhibit 4 to this Application so that construction activities may commence upon Commission authorization.

The construction services will be performed by an outside contractor, AECOM, procured through a competitive request for proposal process, with Duke Energy Kentucky management and oversight. Commencing the construction in late third quarter/ early fourth quarter of 2025 should provide for sufficient time for the conversion construction to be completed by December 2026.

AECOM developed a preliminary design and layout for the conversion of the East Bend WFGD process to LSIO operation. The WFGD process modifications are designed to maintain an SO_2 removal efficiency of at least 98% for the design fuel (5.66 lb. SO_2 / MMBtu).

Exhibit 4 to the Company's Application also includes the maps and drawings that depict the Limestone Conversion Project construction, respectively.

Q. PLEASE DESCRIBE THE CONSTRUCTION SCOPE.

A. Exhibit 4 provides a detailed description of the scope of construction. This includes modifications to existing equipment and is based on the turnkey delivery, including engineering, procurement, and construction. The conversion of the East Bend FGD

system to LSIO operation involves several process, equipment, and system changes including:

- Minor modifications to reagent receiving, conveying, and storage systems;
- Installation of new reagent feeders and conveying equipment;
- Installation of new limestone pre-crushers and grinding mills;
- Refurbishment and resheaving of absorber recycle pumps;
- Installation of new absorber recycle slurry piping, cross-tie piping, spray headers, and spray nozzles;
- Operation of all absorber recycle slurry pumps to enhance SO_2 removal performance;
- Modification of the absorber trays to enhance SO_2 removal performance;
- Installation of a buffer additive storage and feed system to enhance SO_2 removal performance;
- Replacement of existing emulsified sulfur storage tank and fees system to improve system reliability and inhibit sulfite oxidation;
- Upgrade of mist eliminator wash water supply system;
- Replacement of waste slurry storage tank, thickener underflow sludge tank and lime slurry tank agitators; and
- Installation of a filtrate purge system to control process chloride levels.

To the extent existing equipment can be reused or repurposed, the Company will do so in order to minimalize capital costs where possible.

Q. WHAT IS THE ESTIMATED PROJECT CONSTRUCTION SCHEDULE?

A. The Company is targeting an in service date of no later than December 2026. In

order to accomplish this, and taking into consideration the long-lead-time to procure certain components, the Company is requesting approval no later than March 2025. Because the Company cannot engage in construction activities until it receives CPCN approval, it cannot commence procurement of the long-lead time equipment procurement, such as limestone grinding mills, until approval is received. Today, these critical components are estimated to have a 52-54 week lead time. A 10-12 week outage is needed to complete the project and place it into commercial operation. With timely approval, the Company will make every effort to have the station back online and operating before winter 2026/2027 season.

Q. WHAT IS THE ESTIMATED COST OF CONSTRUCTION?

A. The fully loaded estimated cost of construction (with material, engineering, internal and external labor, contingency, and escalation) is approximately $125.8 million. These figures include the cost of demolition and retirement of existing equipment that will no longer be used and the final engineering, design and construction of the new Limestone based system as I detailed above.

Attachment CMD-1 includes a detailed estimate of the costs of construction. The Company anticipates that there will be minimal (<$10,000 per year) incremental operation and maintenance costs (O&M), excluding the reagent commodity. The reagents that will be used on an ongoing basis in the future are limestone for SO_2 absorption, A PH Buffer Additive for SO_2 removal enhancement, and quicklime for WFGD byproduct waste stabilization.

Q. DOES DUKE ENERGY KENTUCKY HAVE THE NECESSARY ENVIRONMENTAL PERMITS TO CONSTRUCT AND OPERATE THE LIMESTONE CONVERSION PROJECT?

A. Yes. Mr. Geers explains and supports these permits in his Direct Testimony.

Q. DID THE COMPANY CONSIDER ANY ALTERNATIVES TO THE LIMESTONE CONVERSION PROJECT?

A. Yes. Mr. Verderame explains the alternatives evaluated and the construction and operation cost comparisons to the Limestone Conversion Project.

Q. DID THE COMPANY ANALYZE WHETHER THE LIMESTONE CONVERSION PROJECT IS THE LEAST COST AND MOST REASONABLE COMPLIANCE ALTERNATIVE FOR CUSTOMERS?

A. Yes. As Mr. Verderame explains, the Company did evaluate two other scenarios, maintaining the status quo and the possibility of mixing standard high calcium quicklime and magnesium hydroxide onsite to deliver the desired chemistry for proper WFGD operation. Neither alternative was a feasible solution.

First, as Mr. Verderame explained, maintaining the status quo would result in significant risks and additional costs to customers resulting from product availability and cost increases. Whereas, based upon historic data and future escalation projections, the Limestone Conversion Project strategy would reduce total variable operating and maintenance (VOM) on the order of [redacted] and an estimated benefit of [redacted] savings in fuel cost and additional off system sales revenues. Shown below are the cost differences between the quicklime and limestone reagents over the last several years and projected forward. Historically

quicklime has escalated at a rate more than double that of limestone, which is the basis for the future projected costs used for project evaluation.

Year	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023 (RFP)	2024 (RFP)	2025	2026	2027	2028	2029
	Current Contract Pricing											Future Projections				
Lime Cost ($/TN)	84.4	87.27	90.24	93.31	97.4	102.4	117.9	123.98	130.04	[redacted]						
Limestone Cost ($/TN)	11.96	9.89	9.4	10.15	11.21	12.92	15.21	14.27	15.37							
Difference ($/TN)	72.44	77.38	80.84	83.16	86.19	89.48	102.69	109.71	114.67							

Similarly, onsite mixing of reagents was not a feasible solution as there was no high calcium quicklime capacity found in the market to supply East Bend's needs. And if there were such a supply available, the Company would need to purchase approximately 190 pounds of magnesium hydroxide per ton of quicklime to meet the required chemical content needed to meet the MEL WFGD specifications. Based upon analysis I performed, using historical data, the purchase of this magnesium hydroxide would increase East Bend's WFGD reagent costs by an additional $95/ton and resulting in approximately $5.7M a year in additional reagent cost based on an annual usage rate of 60,000 tons of magnesium hydroxide. The improved economics of East Bend with the Limestone Conversion Project is a benefit to customers as it will reduce the need for replacement power from the market.

Q. HOW WILL THE LIMESTONE CONVERSION CHANGE THE OPERATIONS OF EAST BEND AND/OR THE REAGENTS IT CONSUMES?

A. As I previously stated, currently the East Bend WFGD operates using MEL for SO_2 removal and quicklime for WFGD byproduct waste stabilization. Converting to limestone will not materially change the operation of the WFGD system, however, two additional reagents will be required for future LSIO operation. Limestone will replace MEL for SO_2 absorption in addition to a new PH buffer additive to help with the dissolution of limestone

and SO2 removal performance. The WFGD byproduct waste stabilization process will remain unchanged and will continue to use quicklime for fixation albeit at a reduced rate due to the improved dewatering characteristics of the LSIO waste sludge.

Q. WILL THESE CHANGES BE REFLECTED IN THE COMPANY'S ENVIRONMENTAL COMPLIANCE PLAN? PLEASE EXPLAIN.

A. Yes. As discussed in Mr. Verderame's testimony Duke Energy Kentucky is seeking authorization to amend its ECP to include the construction and ongoing operation activities necessary for the Limestone Conversion Project. Ms. Lawler explains the expected impact of the requested changes to the ECP on customer bills.

III. CONCLUSION

Q. WERE ATTACHMENTS CMD-1, AND EXHIBIT 4 TO THE APPLICATION PREPARED BY YOU, AT YOUR REQUEST AND/ OR UNDER YOUR DIRECTION AND CONTROL?

A. Yes.

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

A. Yes.

VERIFICATION

STATE OF OHIO)
) **SS:**
COUNTY OF HAMILTON)

The undersigned, Chad Donner, Principal Engineer, being duly sworn, deposes and says that he has personal knowledge of the matters set forth in the foregoing testimony and that the therein are true and correct to the best of his knowledge, information and belief.

Chad Donner, Affiant

Subscribed and sworn to before me by Chad Donner, on this 23rd day of July, 2024.

NOTARY PUBLIC

My Commission Expires: July 8, 2027

EMILIE SUNDERMAN
Notary Public
State of Ohio
My Comm. Expires
July 8, 2027

EB022450-1 East Bend, Limestone Conversion

Estimate Charge Type (Power Plan)	Description	Total
AFUDC Debt (99970)	Power Plan - calculated labor loadings	$ -
AFUDC Equity (99971)	Power Plan - calculated labor loadings	$ -
Company Labor - Exempt (11000)	**PM, PE, Env-SME-Plant Support (2024 thru 2027)**	$ 3,675,000
Company Labor - Union (11002)	**Plant Support, Startup, Training (2026 & 2027)**	$ 438,125
Company Material (21000)	**Storeroom Supplies to Support Project, 2025 - 2027** (ie; valves, instr, flex conduit, piping & tubing fittings, ss tubing, elect matls, threaded rod, plugs, fire blanket, fire ext, safety supplies)	$ 375,000
Contract Labor (69000)	**Engineering (AECOM), Scheduler, Elec Engr, Mech Engr, Ctls Engr - 2024 thru 2027**	$ 7,250,000
Contract Labor (69000)	**Contract Labor-AECOM Est** (Demo, Civil, Concrete, Architectural, Painting & Coating, Mech Eqpt, Piping-Valves-Supports, Insulation, Elec Eqpt, Raceway-Cable-Conduit, Cable, Control & Instr)	$ 34,900,000
Contract Material (31000)	**Contract Material-AECOM Est** (Civil, Concrete. Architectural, Painting & Coating, Piping, Insulation, Elect Eqpt, Raceway-Cable Tray-Conduit, Cable, Control & Instr, Escalation)	$ 30,160,000
Labor Loadings - Exempt (18001)	Power Plan - calculated labor loadings	$ 2,590,000
Labor Loadings - Union (18001)	Power Plan - calculated labor loadings	$ 227,500
Labor Loadings (18000)	Power Plan - calculated labor loadings	$ 120
Contract Labor (69000)	**Subcontract - Duke Managed Scope**	$ 6,745,000
Contract Labor (69000)	**Subcontract - Owners Engineering**	$ 4,125,000
Contstruction Oversight	**Construction Indirects, IM / Construction Management**	$ 8,608,000
Contingency	**Contingency - Duke**	$ 18,200,000
Overhead (78000)	Power Plan - calculated overhead	$ 5,456,000
Stores Loading Allocation (28002)	Power Plan - calculated overhead	$ 72,000
Retirements - Overhead (78000)	Power Plan - calculated overhead	$ (2,231)
Retirements	**Demo Mag Lime Prep Eq.- Labor Cost + Constr Indirect & Contingency**	$ 2,750,000
Retirements	**Demo Agitators/Other- Subcontract Cost**	$ 325,000
Retirements - Salvage (99416)	**Demo Mag Lime Equipment - Scrap Value**	$ (81,969)
	Total Cost =	**$ 125,812,546**

EPC Contract Labor - AECOM Estimate	
$ 3,850,000	Material Handling
$ 12,250,000	Reagent Prep
$ 3,950,000	FGD Area
$ 975,000	Dewatering Area
$ 9,750,000	Fee and profit
$ 4,125,000	Construction Management
$ 34,900,000	**Total**

EPC Contract Material - AECOM Estimate	
$ 3,810,000	Material Handling
$ 17,375,000	Reagent Prep
$ 4,825,000	FGD Area
$ 875,000	Dewatering Area
$ 750,000	Misc. Freight
$ 2,525,000	Misc Ductwork and piping
$ 30,160,000	**Total**

Subcontract L&M - Estimate	
$ 300,000	Civil Work
$ 835,000	Concrete, Asphalt
$ 325,000	Mech Eqpt
$ 725,000	Piping
$ 425,000	Insulation
$ 450,000	Electrical Equipment
$ 850,000	Tank Coatings
$ 1,825,000	Absorber Recirc Pump Rebuilds
$ 325,000	PA System for Reagent Prep Building
$ 275,000	Fire Protection Systems
$ 85,000	FRP Plan & Permitting
$ 325,000	Escalation
$ 6,745,000	**Total**

Owners Engineering Support	
$ 1,825,000.00	Design Review
$ 550,000.00	Quality Control
$ 1,750,000.00	Construction Oversight
$ 4,125,000.00	**Total**

Construction Indirects - Estimate	
$ 467,000	Labor Supervision
$ 1,525,000	Construction CM
$ 652,000	Field Office Expenses
$ 144,000	Pre-Operational Testing
$ 175,000	Site Services
$ 325,000	Temporary Facilities
$ 150,000	Temporary Utilities
$ 175,000	Mobilization/Demob
$ 50,000	Legal Expenses/Claims
$ 125,000	Small Tools & Consumables
$ 755,000	Scaffolding
$ 450,000	Site Improvements
$ 75,000	General Liability Insurance
$ 15,000	Constr. Equip. Mob/Demob.
$ 225,000	Freight on Material
$ 875,000	Quality Control
$ 6,183,000	**Total**

Construction Indirects & Construction Oversight	
$ 6,183,000	Construction Indirects
$ 625,000	Safety Oversight
$ 1,800,000	IM - Performance Contractors
$ 8,608,000	**Total**

Contingency on Estimates	
$ 300,000	Contingency on Constr Eqpt
$ 6,200,000	Contingency on Material
$ 8,500,000	Contingency on Labor & SO
$ 1,500,000	Contingency on Subcontr.
$ 300,000	Contingency on Process Eq.
$ 1,400,000	Contingency on Indirects
$ 18,200,000	**Total**

COMMONWEALTH OF KENTUCKY

BEFORE THE PUBLIC SERVICE COMMISSION

In the Matter of:

The 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. 2024-00152

PUBLIC DIRECT TESTIMONY OF

JOHN A. VERDERAME

ON BEHALF OF

DUKE ENERGY KENTUCKY, INC.

July 25, 2024

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Attachment

JAV-1 Environmental Compliance Plan

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 23 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 Progress Energy Inc. (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, 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 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

[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.

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.

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 and further increased to [redacted]/ton in 2023. 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 adversely affect the competitiveness of the East Bend Station in today's power markets. 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 is due to a lack of a competitive market for the MEL product and the Company currently [redacted] These cost increases are becoming substantial for customers and are making East Bend less and less economic to run. 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 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 Company received [redacted] bids for the requested and complying product. However, [redacted] The Company reached an interim agreement, but at more than double the price of the prior contract. The supplier cited market prices and demand from other industries, including steel production and lithium battery production, as the primary driver for its cost increases.

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

A. Yes. The supplier is not willing to enter into a long-term contract due to anticipated future non-utility demand resulting in upward pressure on future pricing.

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. 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.

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 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.

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.[2] 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 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).[3] While an FRR, unless and until the Company

[2] 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."

[3] 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.

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 deficiency penalty until the Company is able to transition to full participation in the RPM's BRA and IA constructs.[4]

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

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

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.[5] For the second and third year capacity impacts, assuming 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[6] 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.

[5] Penalty = 600 MW x .84 (ELCC Class Rating) x $444.26/MW-Day x 365 days
[6] Replacement Capacity = 600 MW x .84 (ELCC Class Rating) x $100/MW-Day x 365 days

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[7] 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.

Finally, as discussed below and not included in the $166.1 million impact above, the project saves $6.1 million in fuel and purchase power costs, $18.6 million in reagent costs, and $3 million in additional non-native off-system sales margin on average per year.

[7] Replacement Energy = 600 MW x .60 (Net Capacity Factor) x $5/MWh x 8760 hours

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 most future scenarios with reduced variable operational costs of ~$12.03/MWh reducing dispatch cost, increasing economic dispatch of East Bend into the PJM market and reducing reliance on PJM resources to serve customer demand.

Production cost modeling was performed to compare expected East Bend operations using the magnesium-enhanced lime to a system converted to use limestone. This modeling showed a net decrease in forecasted dispatch costs of $12.78/MWh in the 2027 through 2029 operating period when operating on limestone. This represents a 29% decrease from the projected [redacted] cost in the same period when operating on the current lime product. This magnitude of relative value increase would be expected to continue through the operational life of the facility, assuming current conditions and retirement dates.

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

A. Yes. The Company considered entering into a multi-year contract with the supplier but given suppliers market view for non-utility demand suppliers were unwilling to do so. Moreover, the long-term contract strategy would not mitigate the risks [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. Currently, due to the increasing demand for alternative use, domestic high calcium quicklime supply is severely constrained. Finally, the Company would have to truck in the magnesium hydroxide daily to produce the correct WFGD reagent composition. All this would 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 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, staying with the status quo would result, at best, in no change in the Company's

current lime reagent cost detailed above. However, the more likely scenario is that customers and the Company would continue to be at 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.

Second, when considering the process of mixing standard high calcium quicklime and magnesium hydroxide onsite to deliver the desired chemistry for proper WFGD operation, [redacted] Based on this, the Limestone Conversion Project provides a benefit to customers of approximately $18.6 million in annual average reagent savings over the remaining life of the unit while mitigating the identified risks.

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 production cost modeling of the two scenarios show on average a 35% increase in capacity factor in the limestone scenario for the 2027 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 ~1800 GWh over the three-year period. Overall modeled economics are favorable, with the cost to serve the Duke Energy Kentucky customer load reduced by an annual average amount of $6.1 million per year in fuel and purchase power, and $18.6 million in reagent costs from 2027 through 2029, with an additional approximate $3.0 million of annual non-native off-system sales margin in the same period, for a total annual savings of $27.8 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 2027 through 2029 period is projected to decline $1.48/MWh annually, due largely to reducing higher cost of 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 2027 through 2029 period see a net increase of 686 GWhs. As discussed above, this results in an average increase of approximately$3.0 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 a year to complete the construction once the Company receives approval. As depicted in Exhibit 4, sponsored by Witness Donner, the Company is anticipating construction commencing by late fall 2025 with a project completion and operation commencing by the end of 2026.

Q. WILL THE CONSTRUCTION OF THE LIMESTONE CONVERSION PROJECT ADVERSELY IMPACT THE OPERATION OF EAST BEND?

A. In the short term, the Company will perform the construction activities while East Bend continues to operate under the existing WFGD Lime-based process. An approximate three- month outage will be required to tie in the new system.

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 actually positively impacting the stations 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 stop operation, then the Company would be without any source of supply forcing the station to cease operations.

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

A. As explained by Mr. Donner, the estimated fully loaded cost of construction 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.

IV. CONCLUSION

Q. WAS ATTACHMENT JAV-1 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)

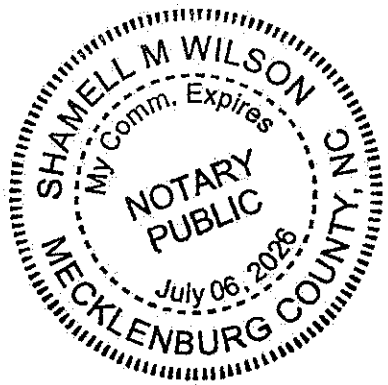
The undersigned, John A. Verderame VP Fuels and Systems Optimization, being duly sworn, deposes and says that he has personal knowledge of the matters set forth in the foregoing testimony and that it is true and correct to the best of his knowledge, information and belief.

John A. Verderame Affiant

Subscribed and sworn to before me by John A. Verderame on this 30 day of April, 2024.

NOTARY PUBLIC

My Commission Expires:



COMMONWEALTH OF KENTUCKY

BEFORE THE PUBLIC SERVICE COMMISSION

In the Matter of:

The 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. 2024-00152

DIRECT TESTIMONY OF

J. MICHAEL GEERS, P.E.

ON BEHALF OF

DUKE ENERGY KENTUCKY, INC.

July 25, 2024

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I. INTRODUCTION AND PURPOSE

Q. PLEASE STATE YOUR NAME AND BUSINESS ADDRESS.

A. My name is J. Michael Geers, and my business address is 139 East Fourth Street, Cincinnati, Ohio 45202.

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

A. I am employed by Duke Energy Business Services LLC, a service company affiliate of Duke Energy Kentucky, Inc. (Duke Energy Kentucky or Company) and a subsidiary of Duke Energy Corporation (Duke Energy Corp.), as Manager of the Environmental Health and Safety (EHS) Energy Transition Group.

Q. PLEASE BRIEFLY DESCRIBE YOUR EDUCATION AND PROFESSIONAL EXPERIENCE.

A. I received a Bachelor's Degree in Chemical Engineering from the University of Dayton in 1981, and a Master's of Business Administration from the University of Cincinnati in 1995. I am also a Registered Professional Engineer in the State of Ohio. After graduation, I joined The Cincinnati Gas & Electric Company (CG&E) as an Assistant Engineer. I have held a number of positions in these organizations of increasing responsibility in the power operations and environmental areas. Some of those positions include Performance Engineer, and Senior Engineer at various coal fired power plants, including the East Bend Station. In March 1997, I joined Cinergy's Environmental Services Air Management Group and was promoted to Principal Environmental Scientist. In April 2006, I was named as the Manager of Duke Energy's Air Management Group within Corporate Environmental Health and Safety Air Management Group. Subsequently I managed the Environmental

Programs Group. My current position is the Manager of the EHS Energy Transition Group.

Q. PLEASE BRIEFLY DESCRIBE YOUR DUTIES AND RESPONSIBILITIES AS MANAGER OF THE EHS ENERGY TRANSITION GROUP.

A. I lead the EHS Energy Transition Group, which has a number of subject matter experts responsible for siting, licensing and permitting activities for projects in the renewables, natural gas, nuclear and new generation areas. Previously as the manager of the Environmental Programs Group, my group was responsible for reviewing new Federal and State regulations such as the Mercury and Air Toxics Standard (MATS), the National Ambient Air Quality Standards (NAAQS) and Cross State Air Pollution Rule (CSAPR), among others, and determining their impact on our generating facilities.

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

A. The purpose of my testimony is to discuss the environmental requirements applicable to Duke Energy Kentucky's operation of East Bend that specifically relate to the Company's need to convert its lime-based wet flue gas desulfurization process (WFGD) 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 and operation and maintenance activities and recovery as part of the environmental surcharge mechanism (ESM). In doing so, I provide an overview of the environmental controls that exist today at East Bend and the regulations that require such controls and any permits required to

perform this work. Finally, I sponsor Exhibit 3 to the Company's Application, the Company's application for a minor air permit modification.

II. ENVIRONMENTAL REGULATIONS IMPACTING DUKE ENERGY KENTUCKY'S EAST BEND GENERATING STATION

Q. WHAT ARE THE MOST SIGNIFICANT ENVIRONMENTAL REGULATIONS CURRENTLY IMPACTING DUKE ENERGY KENTUCKY'S EAST BEND STATION?

A. There are several programs promulgated by the U.S. EPA under the Clean Air Act (CAA) that impact all of the Company's generating stations, and particularly East Bend. These regulations are the primary drivers of Duke Energy Kentucky's compliance strategies for its plants in general and specifically the conversion of East Bend's wet flue gas desulfurization (WFGD) system to Limestone. They are as follows: the New Source Performance Standards for Greenhouse Gas Emissions from New, Modified, and Reconstructed Fossil Fuel-Fired Electric Generating Units, the Mercury and Air Toxics Standard (MATS Rule) and the Cross State Air Pollution Rule (CSAPR) including the U.S. EPA's March 2023 Good Neighbor Plan which further revised CSAPR.

Additionally, although not relevant to the Company's request for approval of the Limestone Conversion Project in this Application, East Bend is also subject to the following rules: 1) the Coal Combustion Residuals (CCR) Final Rule; 2) the Steam Electric Effluent Limitation Guidelines (ELG Final Rule); as well as other emerging regulations under the Clean Water Act (CWA).

Q. PLEASE BRIEFLY DESCRIBE THE CAA.

A. The CAA is the comprehensive federal law that regulates air emissions from stationary and mobile sources. Among other things, this law authorizes EPA to establish a number of programs to regulate air emissions so as to protect public health and public welfare. Many of these programs overlap and at times regulate the same pollutants.

Q. CAN YOU PROVIDE A BRIEF SUMMARY OF THE MATS RULE?

A. The MATS Rule regulates mercury and other toxic air pollutant emissions from new and existing coal- and oil-fired steam electric generating units (EGUs) that are greater than 25 MWs in capacity. It is a command-and-control program that imposes unit-by-unit restrictions on emissions of mercury, acid gases such as hydrogen chloride, and certain non-mercury metals, including arsenic, chromium, nickel and selenium. The MATS Rule allows EGUs, as one option, to demonstrate compliance by measuring mercury, hydrogen chloride, and non-mercury metal emissions directly. It also allows the EGUs the option of demonstrating compliance by measuring surrogates for acid gases and for non-mercury metals. In April, 2024, EPA finalized a revision to the MATS rule which will require compliance in 2027.

Q. DOES EAST BEND CURRENTLY COMPLY WITH THE MATS RULE?

A. Yes. East Bend began complying with MATS Rule promulgated in April 2015. The Company is currently evaluating the changes EPA finalized with the April 2024 rule, but it is believed that these changes have only limited impact on East Bend.

Q. PLEASE PROVIDE A SHORT DESCRIPTION OF THE HISTORY AND STATUS OF THE CLEAN AIR INTERSTATE RULE (CAIR) AND CSAPR.

A. On August 8, 2011, the EPA published the final CSAPR rule to replace CAIR, which was vacated and remanded by the Court of Appeals for the District of Columbia Circuit (D.C. Circuit) in July 2008. CSAPR established new state-level annual SO_2 and NO_x budgets and ozone-season NO_x budgets. The rule was initially scheduled to take effect January 1, 2012; however due to litigation, the CSAPR deadlines were tolled by three years and CSPAR went into effect on January 1, 2015. In October 2016, the U.S. EPA finalized the CSAPR Update Rule, which significantly reduced the ozone season NOx emission budgets for 22 eastern states from those promulgated in the original CSAPR. These budgets, including for Kentucky, took effect on May 1, 2017. This change significantly reduced the number of ozone season NO_x allowances for East Bend. As a result of further litigation the U.S. EPA has published further revisions to CSAPR on April 30, 2021. Then on March 15, 2023, EPA finalized the Good Neighbor Plan for the 2025 Ozone NAAQS (Good Neighbor Plan). Their effect has been to restrict the total number of emission allowances available to East Bend and institute additional changes and restrictions on the national allowance trading program. These new rules are also under litigation. Specifically, due to litigation, EPA is not implementing the Good Neighbor Plan in Kentucky.

Q. HOW HAS CSAPR'S IMPLEMENTATION IMPACTED EAST BEND?

A. Because it has a well performing WFGD system and a selective catalytic reduction control (SCR), East Bend has, to date, been able to comply with CSAPR and its revisions without the installation of additional controls. This is also the case with

the most recent Revised CSAPR Update Rules, the latest of which went into effect in Kentucky for the ozone season beginning May 1, 2021. Because of the restrictions on trading within a small group of states and the more limited state allowance budgets for ozone season NO_x, the allowance prices under the Revised CSAPR Update Rule are significantly higher than they were under the previous versions of the rule. The East Bend SCR design is expected to be robust enough to comply with the Good Neighbor Plan were it to be reinstituted in Kentucky. Under these various programs, and if it is economically prudent, East Bend could also opt to buy or sell allowances on the market.

Q. PLEASE DESCRIBE THE MAJOR EFFORTS TO REGULATE GREENHOUSE GASES THAT RELATE TO ELECTRIC GENERATING UNITS.

A. In 2007, the U.S. Supreme Court ruled in *Massachusetts v. EPA*[1] that greenhouse gases are a pollutant subject to regulation under the CAA. Subsequently, the U.S. EPA has undertaken a number of rulemakings targeting greenhouse gas emissions from EGUs. On June 18, 2014, EPA proposed a rule, known as the Clean Power Plan (CPP) to regulate CO_2 emissions from existing fossil fuel-fired EGUs which was finalized on October 23, 2015. Numerous petitions for review were filed with the D.C. Circuit challenging the legal status of the CPP. On February 9, 2016, the U.S Supreme Court granted a stay of the CPP effective until its legal status is resolved.

[1] *Massachusetts v. Environmental Protection Agency*, 549 U.S. 497 (2007).

On April 4, 2017, the U.S. EPA announced in the Federal Register that it is conducting a review of the CPP, in accordance with an Executive Order by the President issued on March 28, 2017. The EPA indicated that it "if appropriate, will as soon as practicable and consistent with law, initiate proceedings to suspend, revise or rescind this rule." On April 28, 2017, the D.C. Circuit issued an order temporarily suspending the litigation while it considers EPA's motion to stay the litigation while the Agency reviews the rule.

On July 8, 2019, the EPA finalized the Affordable Clean Energy (ACE) rule, and in a separate but related rule repealed the Clean Power Plan and established a process to develop CO_2 emission standards for existing coal-fired power plants.

On February 12, 2021, and with a change in administration, the EPA filed a motion with the D.C. Circuit asking the court to vacate the ACE rule but to stay the issuance of the mandate for the vacatur of the CPP repeal until EPA can respond to the court remand in a new rulemaking regulating CO_2 emissions from existing coal-fired power plants. In a declaration and memorandum accompanying U.S EPA's motion, the agency explains that it interprets the court's decision to have the effect of removing the ACE Rule but not reinstating the CPP. On February 22, 2021, the D.C. Circuit granted this motion.

Q. HAS THERE BEEN ANY RECENT CHANGES TO THE U.S. EPA'S REGULATION OF GREENHOUSE GASES UNDER THE CAA THAT WILL IMPACT THE OPERATIONS AND ASSET LIFE OF EAST BEND? PLEASE EXPLAIN.

A. On May 11, 2023, EPA issued proposed CAA emission limits and guidelines for carbon dioxide (CO2) from new and existing fossil fuel-fired power plants based on cost- effective and available control technologies. The CAA Section 111 directs U.S. EPA to use different approaches for new and existing sources of green house gas emissions (GHG). For new sources of GHG emissions, CAA 111(b) requires the U.S. EPA to set federal standards for new, modified, and reconstructed sources. For existing sources, under CAA 111(d), states submit plans for existing sources containing standards consistent with federal guidelines. On May 9, 2024, EPA published New Source Performance Standards for Greenhouse Gas Emissions from New, Modified, and Reconstructed Fossil Fuel-Fired Electric Generating Units including requirements under Section 111(d) for existing coal fired EGUs.

Q. WHAT ARE THE CAA 111(d) PROVISIONS THAT ARE APPLICABLE TO EXISTING SOURCE COAL FIRED GENERATION THAT WILL LIKELY LIMIT EAST BEND'S OPERATIONS GOING FORWARD?

A. The U.S. EPA has proposed three alternatives for coal-fired generation that include two subcategories for coal-fired units that continue operating, and a third, retirement-based option: 1) Long Term Coal-Fired Steam Generating Units installing and operating carbon capture and sequestration beginning in 2032 with 88.4 percent reduction from baseline may operate indefinitely; 2) Medium Term Coal-Fired Steam Generating Units that elect to cease operations before January 1,

2039, and by January 1, 2030 co-fire 40 percent natural gas that results in a 16 percent reduction in emission rate compared to their baseline; and 3) Units that elect to cease operations (retire) before January 1, 2032. In addition, if a coal unit converts to firing 100 percent natural gas and intends to run past 2039, it must convert by January 1, 2030. These new requirements will impact East Bend and will be implemented as part of a State Plan submitted to EPA for its approval. However, litigation of this new rule has already begun.

III. GENERAL DESCRIPTION OF ENVIRONMENTAL CONTROLS AT DUKE ENERGY KENTUCKY'S EAST BEND GENERATION STATION

Q. PLEASE DESCRIBE THE ENVIRONMENTAL CONTROLS AT EAST BEND.

A. The major environmental and pollution control features at East Bend are a mechanical draft cooling tower, a high-efficiency hot side electrostatic precipitator, a lime-based WFGD system, low nitrogen oxide (NO_x) burners and a selective catalytic reduction (SCR) system. The SCR is designed to reduce NO_x emissions by approximately 85 percent. The WFGD system was upgraded in 2005 to increase the sulfur dioxide (SO_2) emissions removal capability to about 97 percent.

Q. PLEASE EXPLAIN HOW THE WET LIME SCRUBBING TECHNOLOGY CURRENTLY USED AT EAST BEND WORKS AND IS REQUIRED BY ENVIRONMENTAL REGULATIONS.

A. Lime plays a key role in many air pollution control applications. Lime is used to remove acidic gases, particularly SO_2 and hydrogen chloride (HCl), from flue gases. WFGD technology (using lime or limestone) in conjunction with SCR technology is also capable of reducing mercury emissions. SO_2 removal

efficiencies using lime based wet scrubbers range from 95 to 99 percent at electric generating plants. HCl removal efficiencies using lime also range from 95 to 99. There are two main methods for cleaning flue gases from coal combustion at electric generating stations: dry scrubbing and wet scrubbing which both can utilize lime as its reagent. Limestone is also used in wet scrubbing and actually constitutes the largest fraction of installed capacity.

In wet lime scrubbing, lime is added to water and the resulting slurry is sprayed into a flue gas scrubber. In a typical system, the gas to be cleaned enters the bottom of a cylinder-like tower and flows upward through a shower of lime slurry. The sulfur dioxide is absorbed into the spray and then precipitated as wet calcium sulfite. The sulfite can be converted to gypsum, a salable by-product or converted to a stable product that can be landfilled. Wet scrubbing can treat high-, medium-, and low-sulfur fuels where high-efficiency sulfur dioxide removal is required. Wet scrubbing used at East Bend uses magnesium-enhanced lime (containing 3-8% magnesium oxide) because it provides high alkalinity to increase the SO_2 removal capacity and reduce scaling potential.

Q. PLEASE DESCRIBE HOW ASH IS CURRENTLY HANDLED AT EAST BEND.

A. Duke Energy Kentucky currently operates a landfill at East Bend that is used for the disposal of materials and ash resulting from the Company's WFGD process and other CCR-producing processes.

The original or "East" Landfill was comprised of approximately 162 acres and has been in place since East Bend was constructed in 1981. The East Landfill's original construction pre-dated the CCR rule's effective date. The East Landfill now

was closed in a manner that complies with the CCR rule.

The newer or "West" Landfill, once all phases are completed, will consist of approximately 200 acres of lined landfill that is designed to accept approximately 30 years of CCR waste from the East Bend Station and other permitted sources, as needed, to make fixated scrubber sludge. Duke Energy Kentucky received CPCN approval to construct the first cell of the West Landfill in Case No. 2015-00089 and the second cell of the West Landfill in Case No. 2018-00156. As part of the approval in Case No. 2015-00089, the Commission directed the Company to file a new CPCN request prior to commencing construction of each additional phase or cell.

The Landfill is permitted to receive various forms of CCR waste, including, but not limited to, WFGD waste, fly ash and bottom ash (Generator Waste), from a number of generating sources, including those generating stations currently owned and/or operated by Duke Energy Kentucky and from generating stations owned by other Kentucky utilities and Ohio-based electric generators. Dry fly ash is combined into a mixture of WFGD solids, fly ash, and lime, and forms a substance called Poz-o-Tec, which sets up much like concrete, and is placed in the Landfills. Depending upon generation output, East Bend produces approximately 1 million tons of Poz-o-Tec, including approximately 156,000 tons of fly ash annually. In addition, the landfills receive CCR material referred to as bottom ash. The bottom ash had historically been treated in an ash pond (Pond) located on site at East Bend. Duke Energy Kentucky converted its East Bend bottom ash handling system to a complete dry ash system and has completed closing the pond as approved by the Commission in Case No's 2016-00268 and in Case No. 2016-00398.

The presence of the landfills and former Pond has permitted Duke Energy Kentucky to manage its costs of environmental compliance by eliminating the need to transport and pay for sending Generator Waste to commercial landfills.

Q. PLEASE EXPLAIN WHY THE COMPANY'S PROPOSAL TO CHANGE FROM A MAGNESIUM-ENHANCED LIME-BASED SCRUBBING TECHNOLOGY TO A LIMESTONE BASED SCRUBBING PROCESS IS NECESSARY FOR CONTINUED COMPLIANCE WITH ENVIRONMENTAL REGULATIONS?

A. The Limestone Conversion is necessary due to a lack of a competitive market for the magnesium-enhanced lime (MEL) reagent possessing the correct chemical content (magnesium oxide) required to continue operating the WFGD. Without the necessary reagent, the WFGD system cannot operate properly and achieve the necessary SO2 reduction. As a result, East Bend will be unable to operate in compliance with existing and applicable environmental regulations thereby requiring premature shutdown.

Q. PLEASE EXPLAIN IF THERE ARE ANY ALTERNATIVES TO THE LIMESTONE CONVERSION.

A. Company Witness Verderame discusses alternatives evaluated, including long term contracts for lime in his testimony. The Company also considered a process where a standard quicklime product was procured and mixed with magnesium hydroxide slurry on-site as an alternative to the current lime process. For the reasons Witness Verderame explained, that strategy was determined unreasonable.

Q. WHAT WILL HAPPEN IF THE COMPANY CAN NO LONGER OPERATE ITS WFGD?

A. 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 to shut down prematurely and permanently.

Q. WILL THE CONVERSION TO A LIMESTONE BASED REAGENT SCRUBBING PROCESS IMPACT THE OPERATION OF THE EAST BEND LANDFILL?

A. The conversion to a limestone-based reagent will improve the dewatering properties of the calcium sulfite solids produced by the WFGD system. In the current system, these solids are filtered to remove excess water and then significant quantities of fly ash and lime are added produce a stable product (Poz-o-Tec) suitable for disposal in the landfill. With the conversion to limestone chemistry, the improved dewatering properties of the calcium sulfite solids will result in much drier filter cake with a lower water content, and reduced fixation lime requirements. This will reduce the total mass transported to the landfill.

Q. WILL THE COMPANY NEED TO AMEND ANY OF ITS EXISTING ENVIRONMENTAL PERMITS TO COMPLETE THE LIMESTONE CONVERSION PROJECT?

A. As discussed below, the project will only require minor air source permitting. The Company filed the necessary application on July 17, 2024. A true and accurate copy of this application is included as Exhibit 3 to the Company's Application in this proceeding.

Q. PLEASE DESCRIBE DUKE ENERGY KENTUCKY'S PROPOSAL TO AMEND ITS ECP.

A. Duke Energy Kentucky is requesting authorization to amend its ECP to include the construction and ongoing operation and maintenance of the Limestone Conversion Project. Witnesses Verderame and Lawler discuss this further in their respective testimonies.

Q. HAS DUKE ENERGY KENTUCKY RECEIVED THE NECESSARY PERMITS FOR THE LIMESTONE CONVERSION PROJECT?

A. Much of the existing equipment will be reused and will not require re-permitting of the air emissions sources. The Company filed a minor air source permit application on July 17, 2024, that covers the needed changes. It does not foresee any permitting issues that would impact construction. For a minor air permit, the Kentucky DAQ has 60 days to determine if the application is complete. Construction can commence once the application is determined to be complete.

IV. CONCLUSION

Q. WAS EXHIBIT 3 PREPARED BY YOU OR AT YOUR DIRECTION AND UNDER YOUR CONTROL?

A. Yes.

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

A. Yes.

VERIFICATION

STATE OF OHIO)
) **SS:**
COUNTY OF HAMILTON)

The undersigned, J. Michael Geers, Manager EHS Energy Transition Group, being duly sworn, deposes and says that he has personal knowledge of the matters set forth in the foregoing testimony and that the therein are true and correct to the best of his knowledge, information and belief.

J. Michael Geers, Affiant

Subscribed and sworn to before me by Michael Geers, on this _____ day of _____, 2024.

NOTARY PUBLIC

My Commission Expires:

COMMONWEALTH OF KENTUCKY

BEFORE THE PUBLIC SERVICE COMMISSION

In the Matter of:

The 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. 2024-00152

DIRECT TESTIMONY OF

SARAH E. LAWLER

ON BEHALF OF

DUKE ENERGY KENTUCKY, INC.

July 25, 2024

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ATTACHMENTS:

SEL-1 Estimated Revenue Requirement for ESM – Limestone Conversion Project

SEL-2 Typical Bill Comparison

I. INTRODUCTION

Q. PLEASE STATE YOUR NAME AND BUSINESS ADDRESS.

A. My name is Sarah E. Lawler and my business address is 139 East Fourth Street, Cincinnati, Ohio 45202.

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

A. I am employed by Duke Energy Business Services LLC (DEBS) as Vice President, Rates and Regulatory Strategy for Duke Energy Kentucky, Inc. (Duke Energy Kentucky or Company) and Duke Energy Ohio, Inc. (Duke Energy Ohio). DEBS provides various administrative and other services to Duke Energy Kentucky and other affiliated companies of Duke Energy Corporation (Duke Energy).

Q. PLEASE BRIEFLY DESCRIBE YOUR EDUCATION AND PROFESSIONAL EXPERIENCE.

A. I earned a Bachelor of Science in Accountancy from Miami University, Oxford, Ohio, in 1993. I am also a Certified Public Accountant. I began my career in September 1993 with Coopers & Lybrand, L.L.P., as an audit associate and progressed to a senior audit associate. In August 1997, I moved to Kendle International Inc., where I held various positions in the accounting department, being promoted to Corporate Controller. In August 2003, I began working for Cinergy Corp., the parent of Duke Energy Ohio, as External Reporting Manager, where I was responsible for the Company's Securities & Exchange Commission filings. In August 2005, I moved into the role of Manager, Budgets & Forecasts. In June 2006, following the merger between Cinergy Corp. and Duke Energy, I became Manager, Financial Forecasting. In February 2015, I was promoted to

Utility Strategy Director, Midwest, where I was responsible for the preparation of business plans and other internal managerial reporting for Duke Energy Ohio and Duke Energy Kentucky. In December 2017, I assumed the role of Director, Rates and Regulatory Planning where I was responsible for the preparation of financial and accounting data used in Duke Energy Ohio and Duke Energy Kentucky retail rate filings and changes in various other rate recovery mechanisms. In May 2020, I was promoted to my current role of Vice President, Rates and Regulatory Strategy for Ohio and Kentucky.

Q. PLEASE DESCRIBE YOUR RESPONSIBILITIES AS VICE PRESIDENT, RATES AND REGULATORY STRATEGY FOR OHIO AND KENTUCKY.

A. As Vice President, Rates and Regulatory Strategy for Ohio and Kentucky, I am responsible for all state and federal rate matters involving Duke Energy Ohio and its subsidiary, Duke Energy Kentucky.

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

A. Yes. I have previously testified in a number of cases before the Kentucky Public Service Commission (Commission) and other regulatory commissions.

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

A. The purpose of my testimony is to provide an overview of the impact to customers of including the construction activities necessary for the conversion of the current lime-based scrubbing process at the East Bend Generating Station (East Bend) to a limestone-based scrubbing process (Limestone Conversion Project) in Duke

Energy Kentucky's Environmental Surcharge Mechanism (ESM). I discuss the recovery and the Company's proposed timing of said recovery. I also sponsor Exhibit 2 to the application, the financial exhibit and Exhibit 6, the revised ESM Tariff.

II. DISCUSSION

Q. PLEASE BRIEFLY DESCRIBE THE COMPANY'S APPLICATION IN THIS PROCEEDING.

A. Duke Energy Kentucky is requesting a certificate of public convenience and necessity (CPCN) to construct the Limestone Conversion Project in accordance with environmental regulations, and to amend its current Environmental Compliance Plan (ECP) and to adjust its the ESM to include the costs of the project.

Q. HOW DOES DUKE ENERGY KENTUCKY INTEND TO FINANCE THE CONSTRUCTION OF THE LIMESTONE CONVERSION PROJECT?

A. The Company is proposing to finance the construction through continuing operations and, if necessary, through debt issuances. The mix of debt and equity used to finance the project will be determined so as to allow Duke Energy Kentucky to maintain its investment-grade credit rating.

Q. HOW DOES DUKE ENERGY KENTUCKY PROPOSE TO RECOVER THE COST OF THE LIMESTONE CONVERSION PROJECT?

A. Duke Energy Kentucky proposes to recover the cost of the Limestone Conversion Project construction and ongoing operation and maintenance through the ESM once approved in this proceeding. The total estimated capital costs of the construction to be recovered include costs of engineering, construction, and overhead costs. The

ongoing operational costs to be recovered in the ESM include reagents. As discussed in the testimony of Mr. Donner, the Company currently estimates to begin incurring construction expenses in late 2025 with the project in-service no later than December 2026. The Company proposes to begin including costs in its ESM for the Limestone Conversion Project construction activities upon Commission approval. The Company would begin including these costs in its ESM filing for the expense month when Commission approval is obtained for bills issued two months later. In other words, if the Commission issued an order in January 2025, the Company would update the ESM for expense month of January and bills effective March 1.

Q. WHY IS IT APPROPRIATE FOR DUKE ENERGY KENTUCKY TO RECOVER THE COST OF CONSTRUCTION AND OPERATION AND MAINTENANCE ACTIVITIES FOR THE LIMESTONE CONVERSION PROJECT THROUGH RIDER ESM?

A. The ESM is authorized by KRS 278.183(1), which provides in relevant part:

> a utility shall be entitled to the current recovery of its costs of complying with the Federal Clean Air Act as amended and those federal, state, or local environmental requirements which apply to coal combustion wastes and by-products from facilities utilized for production of energy from coal in accordance with the utility's compliance plan as designated in subsection.

The statute goes on to state:

> Recovery of costs pursuant to subsection (1) of this section that are not already included in existing rates shall be by environmental surcharge to existing rates imposed as a positive or negative adjustment to customer bills in the second month following the month in which costs are incurred.

As more fully explained by the Company's application and the direct testimony of Mr. Verderame, Mr. Donner and Mr. Geers, the construction activities required for

the Limestone Conversion Project and the ongoing operation and maintenance of the wet flue gas desulfurization (WFGD) system are necessary for the Company's East Bend Station to continue to comply with both state and federal environmental regulations. The costs of the Limestone Conversion Project are appropriate for eventual recovery through the ESM.

Q. WHAT ARE THE ESTIMATED COSTS OF CONSTRUCTION FOR THE LIMESTONE CONVERSION?

A. As explained and supported in the testimony of Mr. Donner, the estimated fully-loaded cost of construction is approximately $125.8 million including contingency and escalation.

Q. ARE THERE ANY ONGOING COSTS OF OPERATION TO BE RECOVERED THROUGH THE ESM?

A. Yes. As discussed in Mr. Donner's testimony, with the conversion to a limestone-based scrubbing process, the Company will no longer be using magnesium-enhanced lime (MEL) as a reagent for SO_2 absorption and will replace it with the limestone product. A new PH buffer additive for SO_2 removal enhancement will also be used. The Company will also continue to use quicklime for WFGD byproduct waste stabilization. The Company will reflect all of these reagent costs in the ESM going forward.

Q. HAS DUKE ENERGY KENTUCKY ESTIMATED THE IMPACT OF THE LIMESTONE CONVERSION PROJECT TO THE ESM?

A. Yes. Attachment SEL-1 shows the detailed calculation of the estimated annual impact of the construction costs and change in reagent expense on the

environmental surcharge for the years 2025 through 2029, including the estimated annual impact on Total E(m), Jurisdictional E(m), and the incremental billing factors for residential and non-residential customers associated with the project. As shown in Attachment SEL-1, the estimated impact during construction of the project is an increase in the ESM billing factor of 1.12% for residential customers and 1.77% for non-residential customers initially in 2025 and increasing to 3.08% for residential customers and 4.84% for non-residential customers in 2026. Once the project goes into service, the estimated impact is an increase in the ESM billing factor of 2.31% for residential customers and 3.63% for non-residential customers in 2027, and an increase of 1.91% and 1.97% for residential customers and 3.00% and 3.11% for non-residential customers in 2028 and 2029, respectively.

For residential customers using an average of 1,000 kWh per month, the initial monthly increase is expected to be $1.32 or 1.03% in 2025 and $3.63 or 2.84% in 2026. Once the project goes into service, the estimated residential customer increase is expected to be $2.72 or 2.13% in 2027, $2.25 or 1.76% in 2028, and $2.33 or 1.83% in 2029. Attachment SEL-2 provides the estimated bill impact on all residential and non-residential customer rate schedules for the years 2025 through 2029.

Q. PLEASE BRIEFLY EXPLAIN THE DRIVERS OF THE RATE IMPACTS DESCRIBED ABOVE.

A. The rates are increasing in 2025 and 2026 during the construction of the project due to the capital costs of the project. As Mr. Verderame discusses in his testimony, once the project is operating and in service, the reagent expenses will be

significantly lower than they historically were, providing an offset to the overall increase from the capital costs.

Q. DOES THE LIMESTONE CONVERSION PROJECT IMPACT ANY OTHER RIDER?

A. Yes. The Limestone Conversion Project will impact the Fuel Adjustment Clause (FAC) and the Profit Sharing Mechanism (PSM).

Q. PLEASE EXPLAIN THE IMPACT TO THE FAC AND PSM.

A. As Mr. Verderame discusses in his testimony, production cost modeling comparing expected operation using MEL to a system converted to using limestone shows a savings in total variable operating costs. These savings would be expected to continue through the operational life of the facility, assuming current conditions and retirement dates. Mr. Verderame discusses the production cost modeling of the two scenarios (MEL vs. limestone). The limestone scenario shows savings in fuel and purchased power costs of approximately $6.1 million on average per year from 2027 through 2029. These savings will be reflected in the FAC. The production cost modeling also shows an increase in off-system sales margin in the limestone scenario of approximately $3 million on average per year for the same period. These savings will be included in the PSM to be shared with customers.

Q. WHAT IS THE TOTAL OPERATIONAL SAVINGS TO CUSTOMERS EXPECTED TO BE REFLECTED IN ALL THREE MECHANISMS (ESM, FAC AND PSM) RESULTING FROM THE LIMESTONE CONVERSION PROJECT?

A. As discussed above, the Company estimates approximately $6.1 million in FAC

savings on average per year and approximately $3 million in PSM savings on average per year. As discussed in Mr. Verderame's testimony, the Company also estimates savings in reagent costs of approximately $18.6 million on average per year. These savings would be reflected in the ESM. This results in total operational savings as a result of the Limestone Conversion Project of approximately $28 million on average per year that will flow through to the customers through these various mechanisms.

Q. WHY ARE THE EXPECTED REAGENT SAVINGS OF $18.6 MILLION DIFFERENT THAN THAT WHICH APPEARS ON ATTACHMENT SEL-1 AS REAGENT SAVINGS?

A. The reagent expense savings of $18.6 million represents the difference in reagent costs if the Company would have continued to use MEL versus using limestone. This is a different comparison than the initial impact to customers for the ESM discussed earlier in my testimony and shown in Attachments SEL-1 and SEL-2. Those attachments are presenting how current customer bills will change as this project is implemented and as compared to historical ESM rates. The savings I am discussing here ($18.6 million) compare what the costs in 2027 through 2029 would be between the two scenarios. Said another way, the rate impacts discussed and presented in SEL-1 and SEL-2 show incremental increases to customers as a result of this project. The savings being discussed here represents savings going forward between continuing to use MEL and converting to limestone.

III. EXHIBITS SPONSORED

Q. PLEASE IDENTIFY THE EXHIBITS YOU ARE SPONSORING.

A. I am sponsoring two exhibits to the Company's Application; 1) Exhibit 2, the Financial Exhibit and 2) Exhibit 6, the ESM Tariff.

Q. PLEASE EXPLAIN EXHIBIT 2, THE FINANCIAL EXHIBIT.

A. In accordance with 807 KAR 5:001 Section 12(2)(a)-(i), Duke Energy Kentucky is required to include a financial exhibit that, among other things, includes information about stock authorized, issued and outstanding, terms of preferred stock, descriptions of mortgages on property, amount of bonds issued, other indebtedness and related information, and a detailed income statement and balance sheet. Exhibit 2 satisfies that requirement and includes financial information as of May 31, 2024, within 90 days of the date of this Application.

Q. PLEASE EXPLAIN EXHIBIT 6, THE REVISED RIDER ESM TARIFF.

A. Duke Energy Kentucky proposed Environmental Surcharge Mechanism tariff sheet, K.Y.P.S.C. No. 19, Sheet No. 76 is attached as Exhibit 6 to this Application and reflects changes to the issue and effective dates. The ESM tariff included in this Exhibit has an issue date of July 25, 2024, and is proposed to be effective on August 26, 2024 based on the date of the Company's application in this proceeding. The Company projects that bills issued following Commission approval of the application in this proceeding will reflect the revised environmental surcharge.

IV. CONCLUSION

Q. WERE ATTACHMENTS SEL-1 AND SEL-2 AND EXHIBITS 2 AND 6 TO THE APPLCIATION PREPARED BY YOU AND UNDER YOUR DIRECTION AND CONTROL?

A. Yes.

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

A. Yes.

VERIFICATION

STATE OF OHIO)
) **SS:**
COUNTY OF HAMILTON)

The undersigned, Sarah E. Lawler, VP Rates & Regulatory Strategy OH/KY, being duly sworn, deposes and says that she has personal knowledge of the matters set forth in the foregoing testimony and that it is true and correct to the best of her knowledge, information and belief.

Sarah E. Lawler Affiant

Subscribed and sworn to before me by Sarah E. Lawler on this 23rd day of July, 2024.

NOTARY PUBLIC

My Commission Expires: July 8, 2027

EMILIE SUNDERMAN
Notary Public
State of Ohio
My Comm. Expires
July 8, 2027

Line No.		Source	Environmental Compliance Plans 2024	2025	2026	2027	2028	2029
1	Eligible Environmental Compliance Plant (Gross Plant)	Page 2	$ -	$ -	$ 123,332,000	$ 125,801,000	$ 125,801,000	$ 125,801,000
2	Eligible Environmental Compliance CWIP Excluding AFUDC	Page 2	-	46,109,000	-	-	-	-
3	Subtotal	(1) + (2)	$ -	$ 46,109,000	$ 123,332,000	$ 125,801,000	$ 125,801,000	$ 125,801,000
4	Deductions:							
5	Accumulated Depreciation on Eligible Environmental Compliance Plant	Page 2	$ -	$ -	$ 428,065	$ 10,907,288	$ 21,386,511	$ 31,865,735
6	Accumulated Deferred Income Taxes on Eligible Environmental Compliance Plant	Page 2	-	-	881,346	569,853	135,970	(430,221)
7	Accumulated Deferred Investment Tax Credits (ITC) on Eligible Environmental Compliance Plant		-	-	-	-	-	-
8	Subtotal	(5) + (6) + (7)	$ -	$ -	$ 1,309,411	$ 11,477,141	$ 21,522,481	$ 31,435,514
9	Environmental Compliance Rate Base	(3) - (8)	$ -	$ 46,109,000	$ 122,022,589	$ 114,323,859	$ 104,278,519	$ 94,365,486
10	Pretax Rate of Return (ROR)	ES Form 1.20 [1]	8.822%	8.822%	8.822%	8.822%	8.822%	8.822%
11	Return on the Environmental Compliance Rate Base (RORB)	(9) x (10)	$ -	$ 4,067,736	$ 10,764,833	$ 10,085,651	$ 9,199,451	$ 8,324,923
12	Environmental Operating Expenses (OE)							
13	Depreciation Expense	Page 2	$ -	$ -	$ 428,065	$ 10,479,223	$ 10,479,223	$ 10,479,223
14	Taxes Other Than Income Taxes	((3)-(5)) * 1.26091% [1]	-	581,393	1,549,708	1,448,706	1,316,573	1,184,439
15	Environmental Reagent Expense change - Actual vs. Limestone Conversion Project [2]		-	-	-	(12,461,617)	(13,098,135)	(11,822,158)
16	Subtotal	(13) + (14) + (15)	$ -	$ 581,393	$ 1,977,773	$ (533,688)	$ (1,302,339)	$ (158,496)
17	Sub-Total E(m)	(11) + (16)	$ -	$ 4,649,129	$ 12,742,606	$ 9,551,963	$ 7,897,112	$ 8,166,427
18	Jurisdictional Allocation	ES Form 1.10 [1]	98.40%	98.40%	98.40%	98.40%	98.40%	98.40%
19	Jurisdictional E(m)	(17) x (18)	$ -	$ 4,574,743	$ 12,538,724	$ 9,399,132	$ 7,770,759	$ 8,035,764
	Allocation of Estimated Annual Revenue Requirement							
20	Estimated Annual Revenue Requirement	(19)	$ -	$ 4,574,743	$ 12,538,724	$ 9,399,132	$ 7,770,759	$ 8,035,764
21	Residential [1]	42.19%	$ -	$ 1,930,084	$ 5,290,088	$ 3,965,494	$ 3,278,483	$ 3,390,289
22	Non-Residential [1]	57.81%	$ -	$ 2,644,659	$ 7,248,636	$ 5,433,638	$ 4,492,276	$ 4,645,475
	Total Revenues for the twelve months ended May 2024	ES Form 3.00 [1]	$ 321,573,748	$ 321,573,748	$ 321,573,748	$ 321,573,748	$ 321,573,748	$ 321,573,748
23	Residential	ES Form 3.00 [1]	$ 171,957,620	$ 171,957,620	$ 171,957,620	$ 171,957,620	$ 171,957,620	$ 171,957,620
24	Non-Residential	ES Form 3.00 [1]	$ 149,616,128	$ 149,616,128	$ 149,616,128	$ 149,616,128	$ 149,616,128	$ 149,616,128
	Estimated Percentage Increase							
25	Residential	(21) / (23)	0.0000%	1.1224%	3.0764%	2.3061%	1.9066%	1.9716%
26	Non-Residential	(22) / (24)	0.0000%	1.7676%	4.8448%	3.6317%	3.0025%	3.1049%

[1] From Expense Month May 2024 ESM filing
[2] Actual Environmental Reagent Expense per ES Form 2.00 for June of 2023 through May of 2024 compared to Annual Projected Reagent Expense for the Limestone Conversion Project

Project	Annual Spend (Capital) 2024	2025	2026	2027	2028	2029	2030	2031
Limestone Project	$ 6,015,000	$ 40,094,000	$ 77,223,000	$ 2,469,000	$ -	$ -	$ -	$ -
Cumulative Gross Plant	$ 6,015,000	$ 46,109,000	$ 123,332,000	$ 125,801,000	$ 125,801,000	$ 125,801,000	$ 125,801,000	$ 125,801,000
Depreciation Expense	$ -	$ -	$ 428,065	$ 10,479,223	$ 10,479,223	$ 10,479,223	$ 10,479,223	$ 10,479,223
Accumulated Depreciation	$ -	$ -	$ (428,065)	$ (10,907,288)	$ (21,386,511)	$ (31,865,735)	$ (42,344,958)	$ (52,824,181)
Accumulated Deferred Income Tax	$ -	$ -	$ (881,346)	$ (569,853)	$ (135,970)	$ 430,221	$ 1,119,180	$ 1,921,395

Capital in service December 2026

	Book Life[1]	Tax Life
Limestone Conversion Project	8.33%	20.0

			20 Yr MACRS	Tax Depreciation 2024 Capital	2025 Capital	2026 Capital	2027 Capital	2028 Capital	Total Tax Depr	Book Depreciation	ADIT
2024									-	-	-
2025									-	-	-
2026	1	3.750%				4,624,950			4,624,950	428,065	881,346
2027	2	7.219%				8,903,337	92,588		8,995,925	10,479,223	569,853
2028	3	6.677%				8,234,878	178,237	-	8,413,115	10,479,223	135,970
2029	4	6.177%				7,618,218	164,855	-	7,783,073	10,479,223	(430,221)
2030	5	5.713%				7,045,957	152,510	-	7,198,467	10,479,223	(1,119,180)
2031	6	5.285%				6,518,096	141,054	-	6,659,150	10,479,223	(1,921,395)
2032	7	4.888%				6,028,468	130,487	-	6,158,955	10,479,223	(2,828,652)
2033	8	4.522%				5,577,073	120,685	-	5,697,758	10,479,223	(3,832,760)
2034	9	4.462%				5,503,074	111,648	-	5,614,722	10,479,223	(4,854,305)
2035	10	4.461%				5,501,841	110,167	-	5,612,007	10,479,223	(5,876,420)
2036	11	4.462%				5,503,074	110,142	-	5,613,216	10,479,223	(6,898,282)
2037	12	4.461%				5,501,841	110,167	-	5,612,007	10,479,223	(7,920,397)
2038	13	4.462%				5,503,074	110,142	-	5,613,216	10,101,479	(8,862,932)
2039	14	4.461%				5,501,841	110,167	-	5,612,007	-	(7,684,411)
2040	15	4.462%				5,503,074	110,142	-	5,613,216	-	(6,505,635)
2041	16	4.461%				5,501,841	110,167	-	5,612,007	-	(5,327,114)
2042	17	4.462%				5,503,074	110,142	-	5,613,216	-	(4,148,339)
2043	18	4.461%				5,501,841	110,167	-	5,612,007	-	(2,969,817)
2044	19	4.462%				5,503,074	110,142		5,613,216	-	(1,791,042)
2045	20	4.461%				5,501,841	110,167		5,612,007	-	(612,520)
2046	21	2.231%				2,751,537	110,142		2,861,679	-	(11,568)
2047	22					-	55,083		55,083	-	(0)
2048	23					-	-		-	-	(0)
2049	24					-	-		-	-	(0)
2050	25					-	-		-	-	(0)
2051	26					-	-		-	-	(0)
						$ 123,332,000	$ 2,469,000		$ 125,801,000	$ 125,801,000	

[1] Rate based on a 2038 retirement date, 12 years.

Line No.	Rate Code	Level of Demand (a) (kW)	Level of Use (b) (kWh)	Current Bill [1] (c) ($)	2025 Proposed Bill (d) ($)	2025 Dollar Incr/(Decr) (d - c) (e) ($)	2025 Percent Incr/(Decr) (e / c) (f) (%)	2026 Proposed Bill (g) ($)	2026 Dollar Incr/(Decr) (g - c) (h) ($)	2026 Percent Incr/(Decr) (h / c) (i) (%)	2027 Proposed Bill (j) ($)	2027 Dollar Incr/(Decr) (j - c) (k) ($)	2027 Percent Incr/(Decr) (k / c) (l) (%)	2028 Proposed Bill (m) ($)	2028 Dollar Incr/(Decr) (m - c) (n) ($)	2028 Percent Incr/(Decr) (n / c) (o) (%)	2029 Proposed Bill (p) ($)	2029 Dollar Incr/(Decr) (p - c) (q) ($)	2029 Percent Incr/(Decr) (q / c) (r) (%)
1	RS	N/A	1,000	$ 127.64	$ 128.96	$ 1.32	1.0342%	$ 131.27	$ 3.63	2.8439%	$ 130.36	$ 2.72	2.1310%	$ 129.89	$ 2.25	1.7628%	$ 129.97	$ 2.33	1.8254%
2																			
3	DS	30	9,000	$ 1,126.13	$ 1,144.72	$ 18.59	1.6508%	$ 1,177.08	$ 50.95	4.5243%	$ 1,164.33	$ 38.20	3.3921%	$ 1,157.71	$ 31.58	2.8043%	$ 1,158.79	$ 32.66	2.9002%
4																			
5	DP	246	66,667	$ 7,623.63	$ 7,710.79	$ 87.16	1.1433%	$ 7,862.54	$ 238.91	3.1338%	$ 7,802.72	$ 179.09	2.3491%	$ 7,771.69	$ 148.06	1.9421%	$ 7,776.74	$ 153.11	2.0084%
6																			
7	DT	3,840	2,267,189	$ 172,276.25	$ 173,864.24	$ 1,587.99	0.9218%	$ 176,628.76	$ 4,352.51	2.5265%	$ 175,538.93	$ 3,262.68	1.8939%	$ 174,973.66	$ 2,697.41	1.5657%	$ 175,065.66	$ 2,789.41	1.6191%
8																			
9	TT	4,822	1,000,000	$ 107,485.79	$ 108,678.59	$ 1,192.80	1.1097%	$ 110,755.12	$ 3,269.33	3.0416%	$ 109,936.51	$ 2,450.72	2.2800%	$ 109,511.91	$ 2,026.12	1.8850%	$ 109,581.02	$ 2,095.23	1.9493%
10																			
11	EH	N/A	9,400	$ 888.48	$ 897.79	$ 9.31	1.0479%	$ 913.99	$ 25.51	2.8712%	$ 907.60	$ 19.12	2.1520%	$ 904.29	$ 15.81	1.7794%	$ 904.83	$ 16.35	1.8402%
12																			
13	SP	N/A	500	$ 88.96	$ 90.11	$ 1.15	1.2927%	$ 92.10	$ 3.14	3.5297%	$ 91.32	$ 2.36	2.6529%	$ 90.91	$ 1.95	2.1920%	$ 90.97	$ 2.01	2.2594%
14																			
15	GSFL	5	700	$ 434.32	$ 440.88	$ 6.56	1.5104%	$ 452.30	$ 17.98	4.1398%	$ 447.80	$ 13.48	3.1037%	$ 445.47	$ 11.15	2.5672%	$ 445.85	$ 11.53	2.6547%

[1] Based on rates in effect for June 2024.